WATER & SEWAGE WORKS

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WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL

Construction Starts on Second Steel Transmission Main

See "Spartanburg Plans for the Future"—Page 231

How to Maintain Sewage Metering Devices

Design of Water Clarifiers and Cold Process Softeners

JUNE 15, 1955

VALVE OPENING *equals* PIPE OPENING

4" valve ...port area— 12.75 sq. in.

4" pipe ...area— 12.73 sq. in.

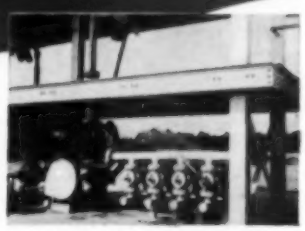
That's the formula of success behind **acf** Rectangular Port Valves! Because they have a port area at least equal to the pipe itself... turbulence and loss of head pressure are held to a minimum... even when handling heavy slurries and other viscous ladings.

All **acf** *Cylindrical* Lubricated Plug Valves... both those with rectangular and round port openings ...feature split-second, quarter-turn shut off that meets the rigid control requirements in the petroleum, natural gas, and processing industries. Maintenance is especially low because they are fitted with TEFLON* gaskets to prevent head leakage, and have no line seats exposed to fluid flow.

ACT NOW TO KEEP DOWN VALVE MAINTENANCE COSTS!

Representatives in 50 Principal Cities. Write for Descriptive Catalog 5-WS, **acf** Industries, Incorporated, Valve Division, 1501 E. Ferry Avenue, Detroit 11, Mich.

*DuPont Tradename



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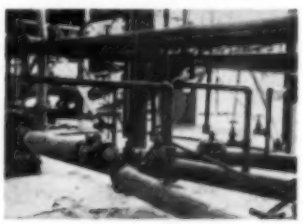

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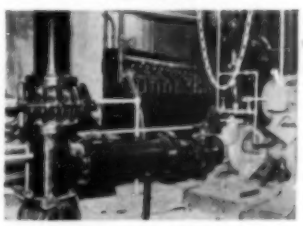

In Sewage Treatment

acf CYLINDRICAL FULL PIPE AREA **PLUG VALVES**

MUELLER®

DEPENDABLE... in any main

Sizes ½" through 2"
Shipment from stock
Fully Warranted

Years of trouble-free service in mains of widely differing materials have proven the dependability and strength of Mueller Corporation Stops. A wide variety of inlet and outlet threads, a unique compression joint inlet, and other special inlets and outlets, are available to fit your needs — whatever they may be.

Designed for easy insertion under pressure, these stops are made entirely from the finest Water Works Bronze. All keys are precision machined and individually ground and lapped into the stop body. Each stop is carefully inspected and pressure tested. Exposed threads are coated with plastic to prevent shipping damage.

Consult your Mueller Representative, your W-96 Catalog or write direct for full specifications.

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Dependable since 1857

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SODIUM CHLORITE PRODUCES

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CHLORINE DIOXIDE

SAVES TROUBLE, MONEY ... SOLVES YOUR WATER TREATMENT PROBLEMS

Want a low-cost source of chlorine dioxide and one that's easy to use as well?

Then just dissolve Mathieson sodium chlorite in water, activate it with chlorine or hypochlorite . . . and get a powerful bactericidal agent containing the equivalent of 263% available chlorine!

Used in conjunction with chlorine from a conventional chlorinator, this high potency chlorine dioxide solution, plus any desirable excess of chlorine from the generating process, will solve your water treatment problems.

Moreover, this method saves time and trouble. It permits the introduction of the bactericidal solution right at the desired point of application. Unlike breakpoint or superchlorination, it requires little control or supervision. And it also eliminates the need for carbon and ammonia in the control of taste and odor in municipal waterworks operations.

This method may also be used to maintain a free residual in distribution systems . . . to effect iron and manganese elimination . . . and to control the offensive tastes and odors produced by phenols, algae and industrial wastes.

Mail the coupon for additional information about sodium chlorite's effectiveness and its many money-saving applications in municipal operations.

MATHIESON

Technical grade sodium chlorite, recommended for municipal applications, is available as buff-colored, dry, hygroscopic flakes in 25-lb. pails, 100-lb. drums . . . and 8,000-gal. 50% solution tank-car lots.

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Industrial Chemicals Division
Baltimore 3, Maryland

Please send information on Mathieson sodium chlorite.

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COMPANY.....

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WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT

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Colonies of Serratia marcescens cultured on MF® surface for 16 hours with PM2X media.

MILLIPORE FILTERS

It has been recently announced that the 10th edition of ***Standard Methods for the Examination of Water and Sewage*** will include the **MF®** procedure for bacteriological water testing.

Application of **MF®** membranes* has permitted refinements and simplifications in many microbiological procedures and in the analysis of other colloidal suspensions as reported in leading technical journals.

- The **MF®** filter membranes reduce bacterial cells quantitatively to a plane surface by a remarkable "screening" phenomenon.
- Bacteria on the filter surface may be cultured under conditions subject to control not heretofore obtainable.
- Uniform and rapid development of colonies contributes to the ***accuracy, sensitivity,*** and ***reliability*** of **MF®** procedures.

A comprehensive summary of the literature descriptive of the Millipore Filter membranes, complete accessory equipment, and reported techniques of application is available on request from the laboratories of the

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Watertown 72, Mass., U.S.A.

****Sometimes referred to as membrane or molecular filters.***

...And Ring-Tite Joints for

RENSSELAER-COREY HYDRANTS

Now for the first time, Rensselaer Hydrants as well as valves are available with Ring-Tite Joints.

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CONSTRUCTION TIME REDUCED

This feature will speed up hydrant installations and provide tight, flexible joints.

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FOR ALL SIZES

Rennselaer Fire Hydrants 4" and 5" with Ring-Tite Bells can be connected to 4" and 6" and 8" Transite Pipes. Lugs are provided to tie the Hydrant to the pipe line.

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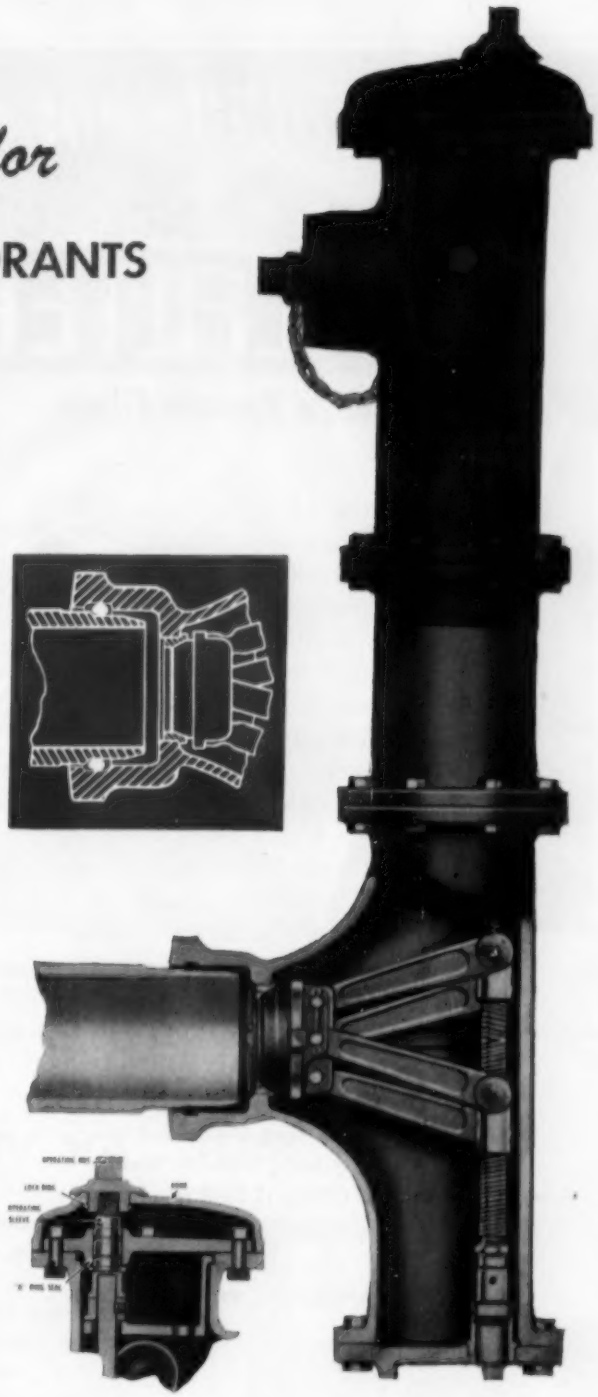
Rensselaer Fire Hydrants are designed on the knuckle joint principle and open with the pressure. They are quick opening with free-flow, long radius curves. Will not freeze or flood and no digging is required for repairs or standpipe breakage.

The Rensselaer Hydrant has been preferred by superintendents, fire chiefs and maintenance men for more than half a century.

Ask for Bulletin G.



RENSSELAER HYDRANT WITH "O"-RING SEAL AND RING-TITE JOINT.

Rensselaer VALVE CO. TROY, N. Y.

GATE VALVES • FIRE HYDRANTS • SQUARE BOTTOM VALVES • CHECK VALVES • AIR RELEASE VALVES

SALES REPRESENTATIVES IN PRINCIPAL CITIES

Division of the Ludlow Valve Manufacturing Co., Inc.

The Fulfillment of a Promise . . .

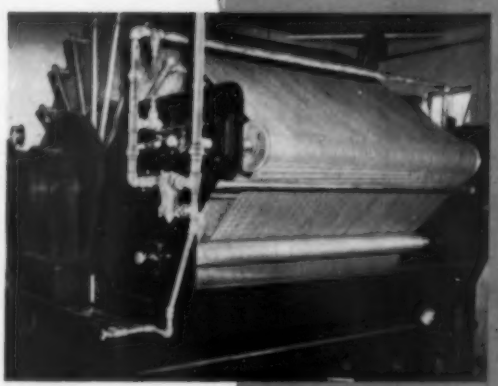
KOMLINE-SANDERSON COILFILTER

Sludge Vacuum Filters

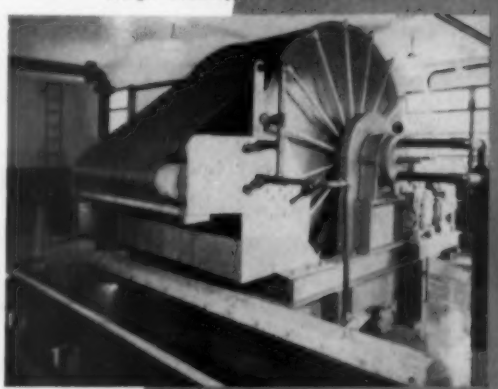
From its beginning in 1946, the development and ever-increasing acceptance of the KOMLINE-SANDERSON COILFILTER has meant the fulfillment of a promise. First: To those who conceived and put into being this significant step in modern sludge dewatering. Secondly: To the engineers and municipalities who have helped to prove the great efficiency and economy of these self-cleaning, rugged, high-output filters.

Starting with the first installation at Liberty, N. Y., in 1949, the acceptance of COILFILTERS has increased steadily, even spectacularly. In 1954 the number of COILFILTERS purchased for sewage sludge dewatering was more than five times the number of all other makes combined. Production facilities at our Peapack, N. J. plant have recently been quadrupled and plans are already being made for another expansion. The COILFILTER is indeed fulfilling its promise.

For more information, write for Bulletin No. 102.



1949 The first COILFILTER installation, a 150 sq. ft. unit for the dewatering of digested sludge at Liberty, New York.

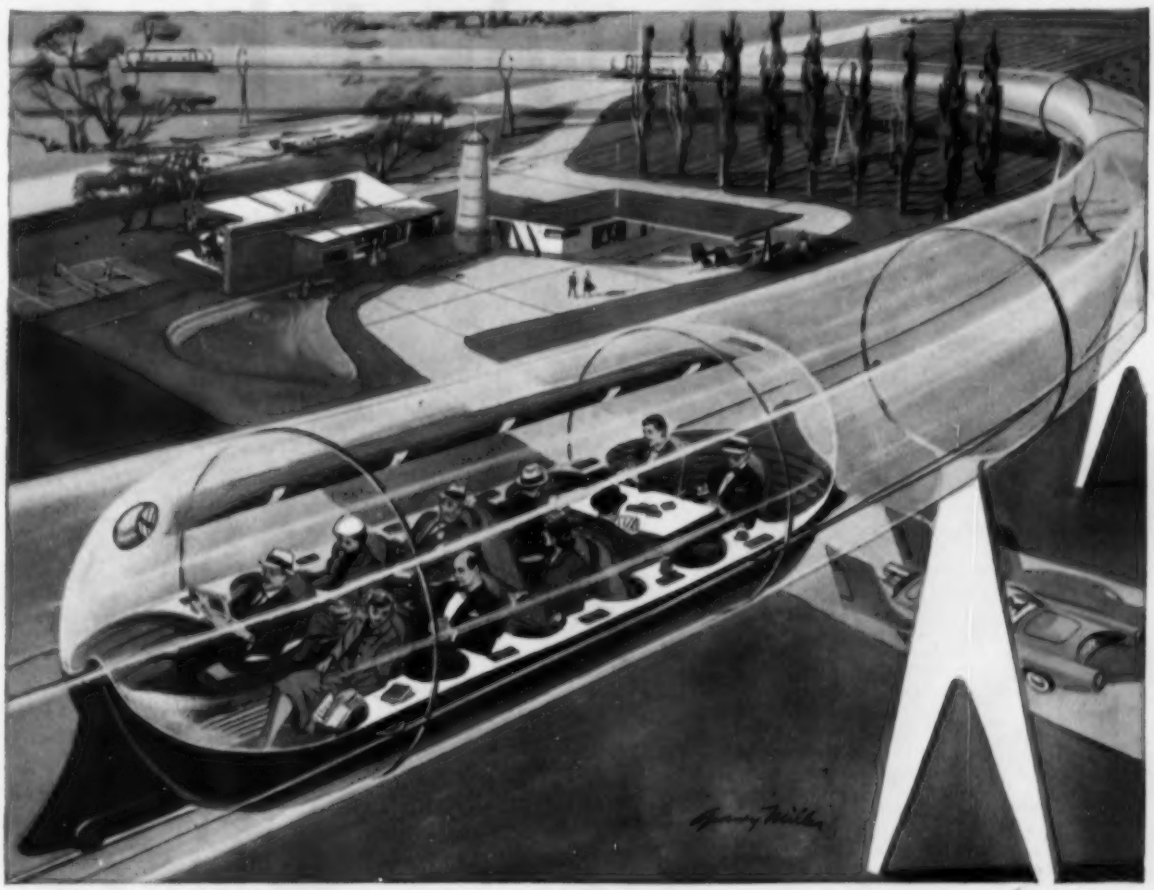


1954 A 100 sq. ft. COILFILTER at Conshohocken, Penna. This unit replaced two 100 sq. ft. cloth-type filters.

KOMLINE-SANDERSON ENGINEERING CORPORATION

Peapack, New Jersey

Manufacturers of the* COILFILTER . . . *the modern sludge vacuum filter



"TRAVEL CAPSULES" . . . air-conditioned, plastic-enclosed, propelled at high speeds along elevated tubeways . . . immune to weather, traffic delay, mechanical breakdown. Science is exploring its possibilities now.

100 years from now...

WE MAY TRAVEL BY VACUUM TUBE!

Many fantastic developments...today only dreams and lines on an engineer's blueprint...may become the commonplace of the future.

But in that world to come, one highly useful servant will continue its public service much as it does today. Cast iron pipe laid today will still carry our gas and water.

Records show that over sixty American cities are served by cast iron gas and water mains laid in the ground over a hundred years ago! And today, U. S. Pipe, centrifugally cast and quality-controlled, is even more serviceable.

U. S. Pipe is proud to be one of the leaders in a forward-looking industry whose service to the world is measured in centuries.

U.S.
cast iron
PIPE
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE
CAST IRON

U. S. PIPE AND FOUNDRY COMPANY, General Office: Birmingham, Alabama

A WHOLLY INTEGRATED PRODUCER FROM MINES AND BLAST FURNACES TO FINISHED PIPE.

what have

The Pacific Salmon
will travel many miles and
overcome many obstacles to reach
the upper stretches of rivers
where instinct tells it to lay its eggs.
After spawning the fish dies.

This cast iron water main is entering
its second century of economical service
to the citizens of Sacramento, California.

MODERNIZED cast iron

they in common...

THE SALMON AND CAST IRON PIPE...DEPENDABILITY!

Spawning salmon can be counted on to return to the rivers where they were born. CAST IRON PIPE can be depended upon, too... to give years of trouble-free service, often for centuries.

AND HERE'S THE PROOF: Listed below are some of the many water utilities still using cast iron pipe that was installed a century or more ago.

DEPARTMENT OF WATER AND WATER SUPPLY, City of Albany, New York
ALEXANDRIA WATER COMPANY Alexandria, Virginia
BUREAU OF WATER, DEPT. OF PUBLIC WORKS, Baltimore, Maryland
PUBLIC WORKS DEPT., WATER DIVISION Boston, Massachusetts
DEPARTMENT OF PUBLIC WORKS, DIVISION OF WATER, Buffalo, N. Y.
WATER WORKS DEPARTMENT Chicago
COLUMBIA WATER COMPANY Columbia, Pennsylvania
BOARD OF WATER COMMISSIONERS Detroit, Michigan
CITY OF FREDERICK WATER DEPT. Frederick, Maryland
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WATER BUREAU OF THE METROPOLITAN DISTRICT, Hartford, Connecticut
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PENNICHUCK WATER WORKS Nashua, N. H.
WATERWORKS DEPARTMENT City of Nashville, Tennessee
DEPT. OF WATER, GAS & ELECTRICITY New York, New York
DEPT. OF PUBLIC WORKS, BUREAU OF WATER, Philadelphia, Pennsylvania
BUREAU OF WATER, DEPT. OF PUBLIC WORKS, Pittsburgh, Pennsylvania
POTTSVILLE WATER COMPANY Pottsville, Pennsylvania
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DEPT. OF PUBLIC UTILITIES (WATER) Richmond, Virginia
DIVISION OF WATER & SEWERS Sacramento, California
WATER & SEWERAGE DEPARTMENT City of Saint John, N.B.
DEPT. OF PUBLIC UTILITIES, WATER DIVISION, St. Louis, Missouri
WATER DIVISION, DEPT. OF ENGINEERING, Syracuse, New York
DEPT. OF PUBLIC WORKS Troy, New York
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CITY OF WHEELING WATER DEPT. Wheeling, West Virginia
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WATER DEPARTMENT City of Winchester, Virginia
WATER DEPARTMENT City of Winston-Salem, North Carolina
YORK WATER COMPANY York, Pennsylvania
WATER DEPARTMENT City of Zanesville, Ohio

TODAY... modernized cast iron pipe, centrifugally cast, is even tougher, stronger, more uniform. *Where needed and specified,* it is centrifugally lined with cement mortar to assure sustained carrying capacity throughout its long years of service.

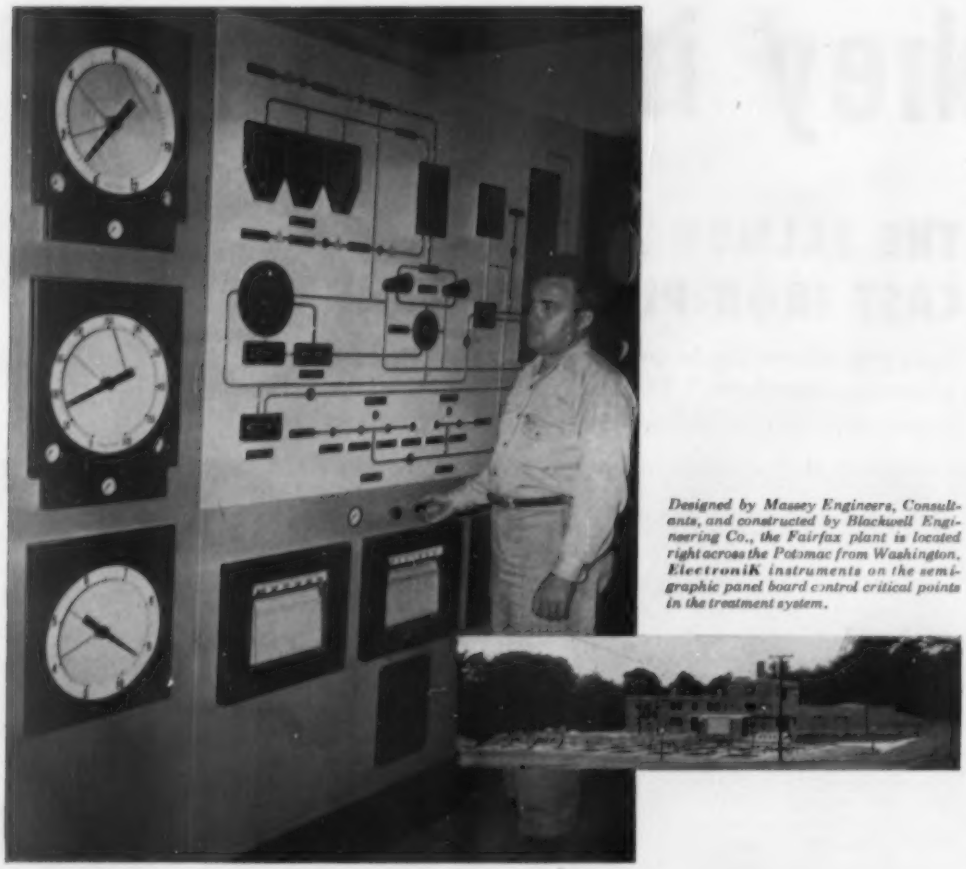
Cast iron pipe's record of performance... measured in centuries... make it the world's most dependable carrier of water.

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Avenue, Chicago 3, Ill.

CAST Q IRON

The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

pipe FOR MODERN WATER WORKS



Designed by Massey Engineers, Consultants, and constructed by Blackwell Engineering Co., the Fairfax plant is located right across the Potomac from Washington. ElectroniK instruments on the semi-graphic panel board control critical points in the treatment system.

Brown instruments guide critical processes in Fairfax County's new plant

The $1.5 million sewage treatment plant, comprising many unique features, just completed by Fairfax County, Virginia, is making a big contribution toward cleaning up the Potomac. Designed to care for a community of 80,000, this modern plant makes good use of the most up-to-date treatment techniques . . . including accurate, automatic supervision of critical operations by Brown instruments.

ElectroniK instruments control temperatures in the sludge dryers, to assure thorough moisture removal at maximum fuel economy. Another *ElectroniK* instrument records pH of effluent as a final check on overall system performance. Multi-point *ElectroniK* recorders provide continuous spot checks of other vital plant temperatures, to guide operators in supervising processes.

The leading choice of designers and consultants in the water and sewage treatment field, Brown instrumentation has been selected for many of the country's outstanding installations. This diversified line of equipment covers practically every requirement of modern treatment processes . . . and it is backed by prompt, competent service from some 90 Honeywell service centers.

Your local Honeywell sales engineer will welcome the opportunity to discuss specific requirements with you and your consulting engineer. Call him today . . . he's as near as your phone.

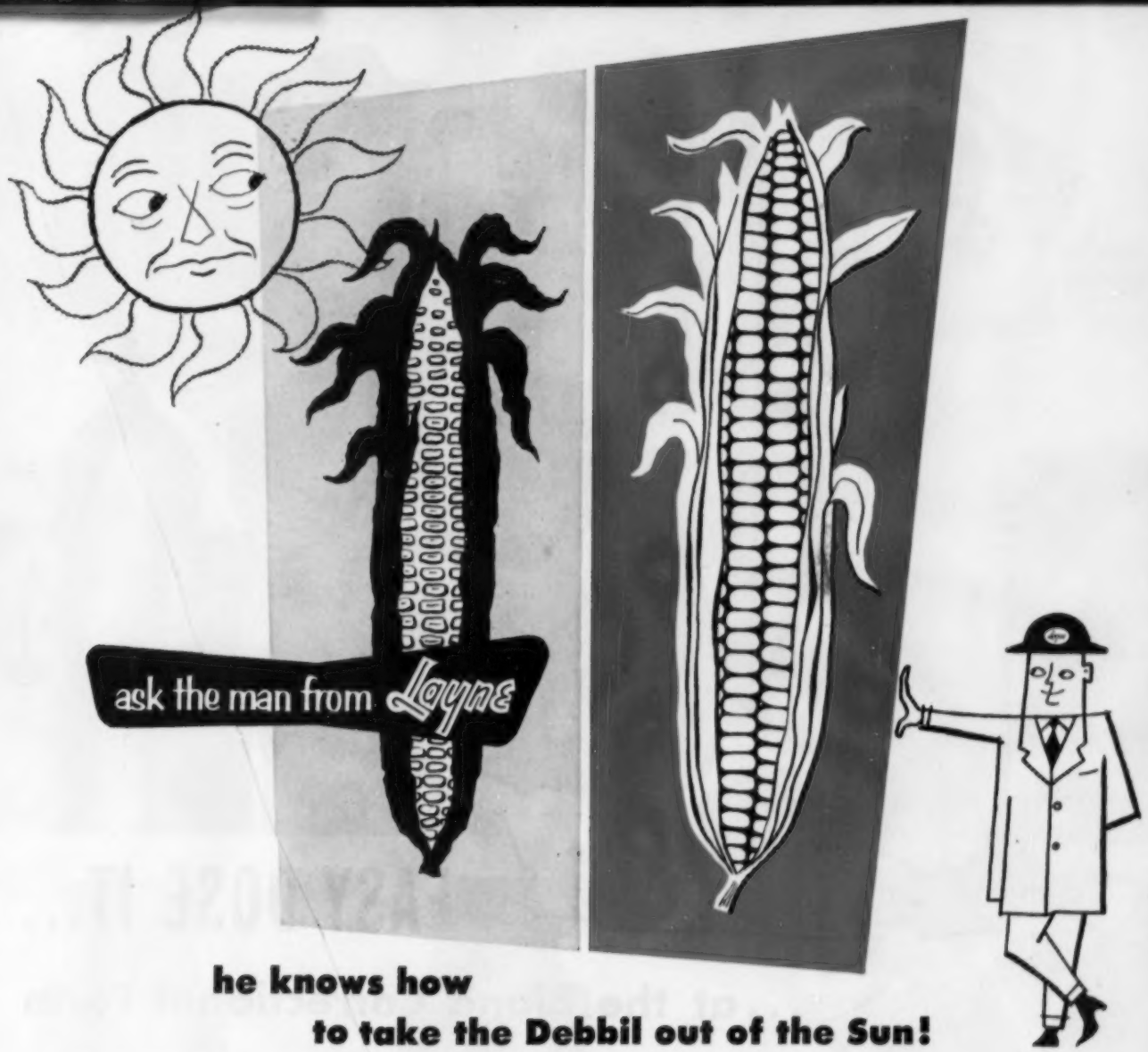
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

● **REFERENCE DATA: Write for Bulletin 7302, "Instrumentation for Water, Sewage and Industrial Waste Treatment"**

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls



he knows how to take the Debbil out of the Sun!

Old Sol—Devil or Saint can be . . . but to the farmer or rancher who has proper irrigation, the Sun is all Saint.

Layne knows a great deal about irrigation in all its phases because Layne knows a great deal about water, including development of ground water resources . . . utilization of existing water sources . . . application as well as proper equipment designed to meet specific conditions. Layne service to industry, agriculture and municipality has made Layne the world's largest developer of ground water resources—and that fund of knowledge is yours without cost or obligation when you "ask the man from Layne."

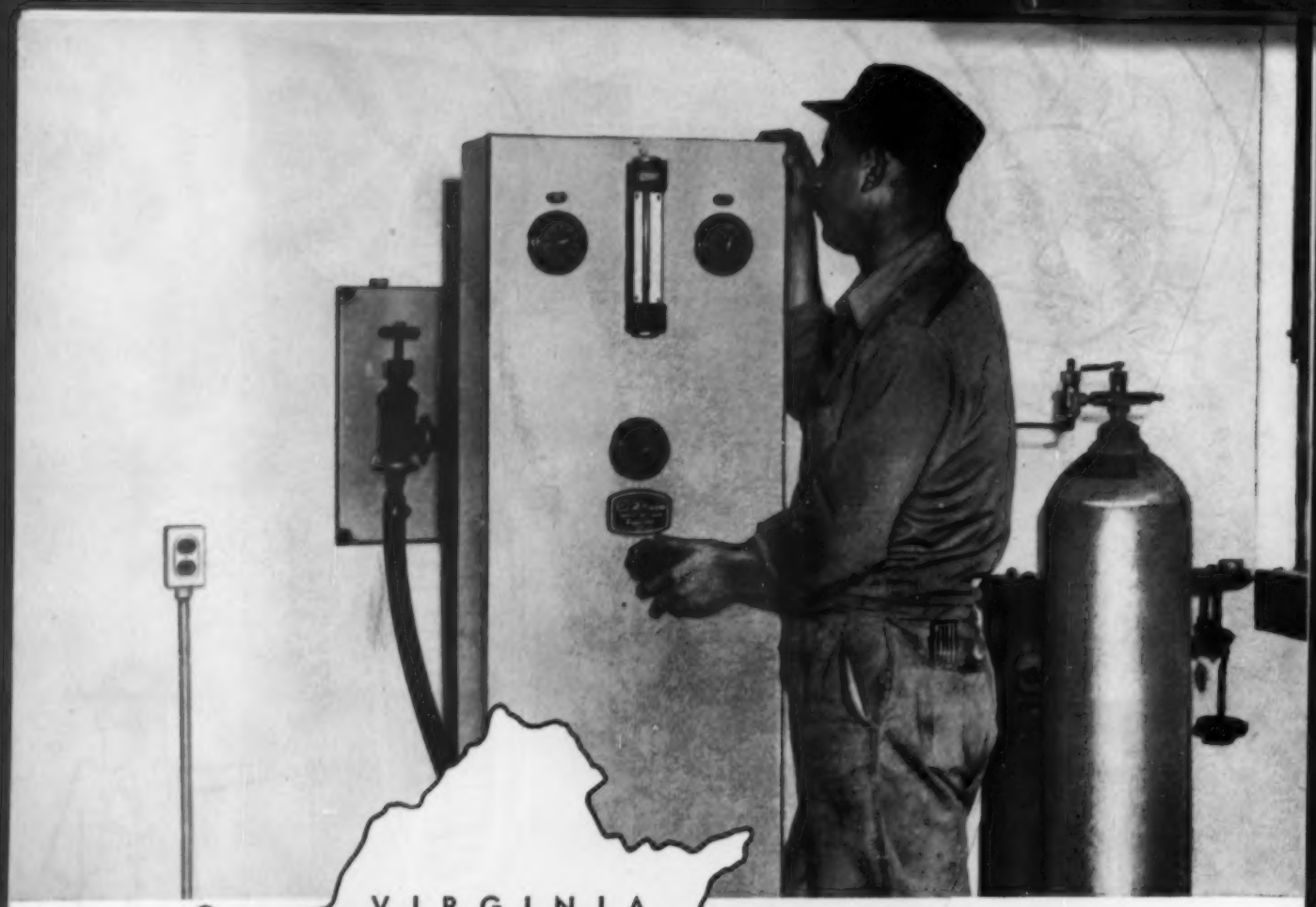
LAYNE & BOWLER, INC.

Memphis 8, Tennessee

Layne Associate Companies Throughout the World

water wells • vertical turbine pumps • water treatment

Layne



EASY DOSE IT...

...at the Bland Correctional Farm

Operating personnel at the Bland Correctional Farm in White Gate, Virginia, report this Builders Model DVS Chlorinizer has been mighty easy to work with ever since it was installed in early 1951. Due to Chlorinizer's positive-acting chlorine control system, plant personnel have been able to set the chlorine dosage at the exact rate required by their water sterilization needs. Plant operator Johnson is shown in the photo adjusting the feed rate and double checking the adjustment on the direct-reading Sightflo indicator which meters total chlorine flow. Beyond the replacement of chlorine cylinders and an occasional check on chlorine flow rate, the Builders Chlorinizer has required no appreciable service or maintenance since installation.

Hundreds of performance reports like this are coming in from Chlorinizer users in municipalities, institutions, and industries throughout the country. If you are considering new chlorination capacity, or replacement of present chlorination equipment, why not check your nearest Chlorinizer installation. We will be glad to send you a list of Chlorinizer users in your area . . . and also bulletins describing the four basic Chlorinizer models. Write, today, to Builders-Providence, Inc., 350 Harris Ave., Providence 1, Rhode Island.

BUILDERS-PROVIDENCE

DIVISION OF B-I-F INDUSTRIES, INC.

BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC. • OMEGA MACHINE CO.

BIF METERS FEEDERS CONTROLS

HERSEY WATER METERS

have been approved and recommended by many experienced water works engineers for their unusual reliability and accurate registration.

In addition, one of their real outstanding features is the consistent low-maintenance cost over a long period of time. REASON: Hersey has never been known to cheapen materials or slight workmanship to meet price competition. Very often a low-cost meter can prove an expensive long-time investment.

HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO
SAN FRANCISCO — LOS ANGELES

Transite Sewer Pipe provides these 4 basic economies

The engineer, the contractor and the taxpayer —all benefit when Transite® Pipe is used for sewer lines. Costs are cut in many ways—among them the four basic Sewer Pipe economies . . . in system design . . . in installation . . . in operation . . . in maintenance. If you make a quick run-through of the following condensed check list, chances are you will find savings which apply directly to your sewer system problems.

1. System Design

- Use of smaller diameter pipe
- Installation at flatter slopes

(Typical Economies)

- Installation in shallower trenches
- Savings in amount of material excavated
- Smaller earth loads
- Elimination of cradling
- Location of treatment plant at higher level
- Elimination of pumping

Users have found—With its high flow capacity (flow coefficient n= 0.010 derived from the Manning formula) and with its maintained strength, Transite Sewer Pipe contributes to typical system design economies.

2. Installation

(Typical Economies)

- Fewer joints
- Easier handling
- Smaller crews
- Speedier assembly
- Assurance that joints pass severe infiltration tests

Users have found—With its longer lengths, light weight, ease of assembly and tight, quickly made joints, Transite Sewer Pipe contributes to typical installation economies.

3. Operation

(Typical Economies)

- Infiltration treatment cost drastically reduced
- Only normal sewage treated

Users have found—With its tight joints connected by Johns-Manville's Ring-Tite® Coupling, Transite Sewer Pipe contributes to typical operation economies.

4. Maintenance

(Typical Economies)

- Tree roots kept out—minimizes cleaning
- Sewers kept smooth and intact—pipe stays strong, joints stay resilient
- Need for frequent inspections reduced

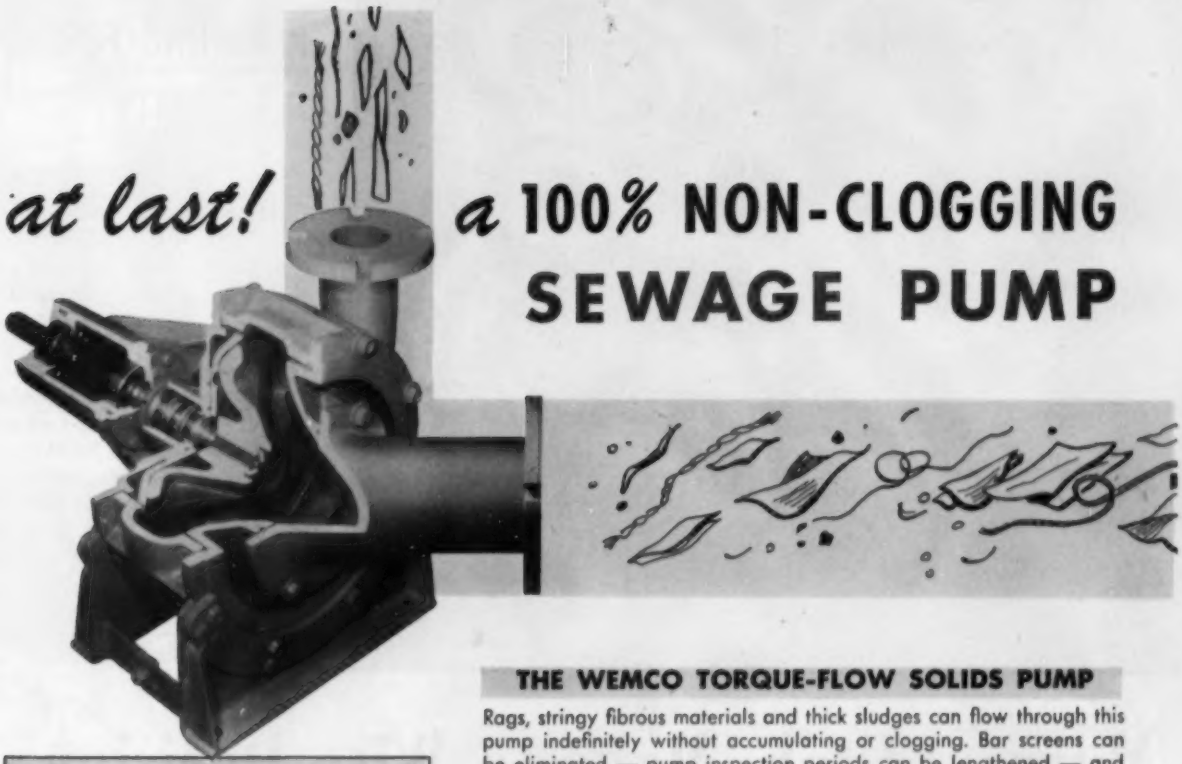
Users have found—With its maintained strength and with its tight joints, Transite Sewer Pipe contributes to typical maintenance economies year after year.

For further information and your copy of TR-94A, helpful, widely used Sewer Design Flow Chart based on the Manning Formula, write Johns-Manville, Box 60, New York 16, New York

Johns-Manville TRANSITE SEWER PIPE

the asbestos-cement sewer pipe with the tight joints

at last! a 100% NON-CLOGGING SEWAGE PUMP



THE WEMCO TORQUE-FLOW SOLIDS PUMP

Rags, stringy fibrous materials and thick sludges can flow through this pump indefinitely without accumulating or clogging. Bar screens can be eliminated — pump inspection periods can be lengthened — and messy pump teardowns become almost a thing of the past.

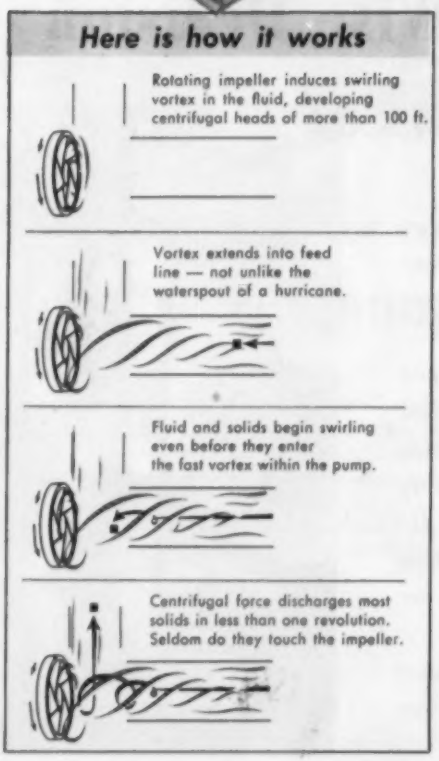
FIELD PROVEN BY LOS ANGELES COUNTY SANITATION DISTRICT

A "hand made" early model Wemco Pump was installed on a 90 day trial pumping raw settled sludge. Previous modern pumps had been ragging-up in excess of four times per week. The trial period was completely successful. Not a single stoppage occurred. Even this hand made model is still in continuous operation after more than fourteen months. This resulted in many additional pumps being installed at other critical points in the system.

COMPLETELY NEW IN CONCEPT

Success of the Wemco Torque-Flow Solids Pump is due to its unique new principle. Nowhere is its flow passage narrower than the discharge — and there are no rag catching projections, corners, or edges. The impeller is recessed from the main flow. It pumps by inducing a vortex and swirl. It will create suction lifts greater than 20 feet or pump heads of 100 feet and more.

Here is how it works


Rotating impeller induces swirling vortex in the fluid, developing centrifugal heads of more than 100 ft.
Vortex extends into feed line — not unlike the waterspout of a hurricane.
Fluid and solids begin swirling even before they enter the fast vortex within the pump.
Centrifugal force discharges most solids in less than one revolution. Seldom do they touch the impeller.

Write for full particulars to Dept. L-2045

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WESTERN MACHINERY COMPANY
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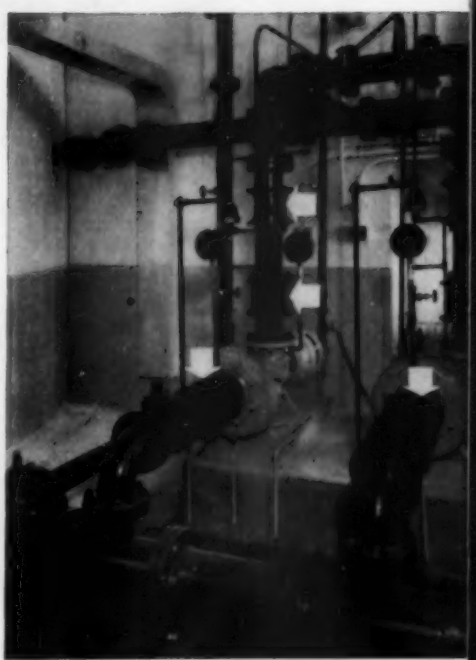
PLANNING FOR FLEXIBILITY

This modern sewage treatment plant in Murray, a suburb of Salt Lake City, has a capacity of 3 mgd, provides screening, grit removal, sedimentation and trickling filtration. Dresser Couplings were specified to take care of movement or misalignment and for easy installation, trouble-free service. Engineering was by Headman, Ferguson & Carollo of Phoenix; construction by Barker Construction Co. of Salt Lake City.

Murray, Utah, Makes a Wise Decision

INSTALLS DRESSER COUPLINGS FOR PERMANENT, VIBRATION-PROOF PIPING



Like so many expanding communities, Murray depends on Dresser Couplings to insure low-cost pipe connections that are bottle-tight yet flexible to absorb pipe stresses.

For every Dresser Coupling has strong, resilient, wedge-shaped gaskets to cushion vibration, protect pumps from pipe-transmitted stresses, maintain no-leak sealing for life. The Dresser way cuts joining time and expenses sharply. All problems of exact pipe fitting and alignment are eliminated.

In addition, these couplings permit fast disassembly for servicing or pump replacement. Wrench-installed in but 2 man-minutes per bolt, they can be taken apart just as quickly and as easily!

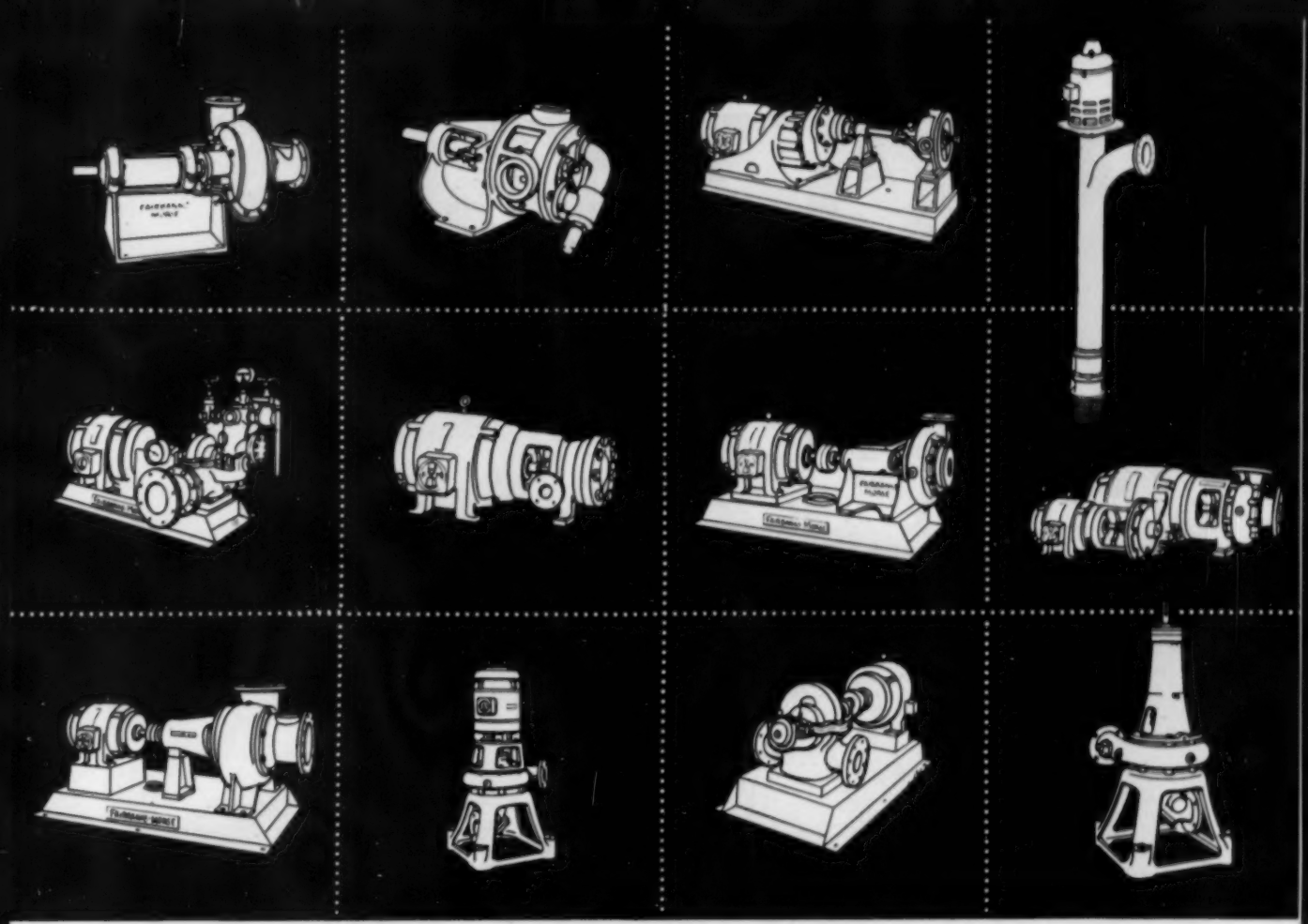
Plan now to have the advantages of Dresser Couplings on your next sewerage project or water job. They've proved the truly modern way to get permanent joints and low-cost piping flexibility!

√ See your piping supplier today on how you can save on sewerage and water projects.

DRESSER®

75th ANNIVERSARY THE DRESSER WAY 1880-1955

Dresser Manufacturing Division, 69 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston; 101 S. Airport Blvd., S. San Francisco. Sales Offices also in: New York, Philadelphia, Chicago, Toronto.



YOU CAN RELY ON YOUR F-M PUMP ENGINEER...

to solve any pump problems!

Troubled by a pumping problem? There's an easy solution. Call your Fairbanks-Morse Field Engineer. His business is solving your problems . . . selection and applying pumps that will answer your needs most economically and efficiently.

Because Fairbanks-Morse is the world's largest manufacturer of a complete pump line, your Fairbanks-Morse Field Engineer is not handicapped in his recommendations. He can select the pumps that offer you the most for your pump dollar. He has the field experience and is backed by the most experienced pump engineering department in the business. To solve your pump problems, call your Fairbanks-Morse Field Engineer. Fairbanks, Morse & Co., Pump Division, 3601 Kansas Ave., Kansas City, Kansas.

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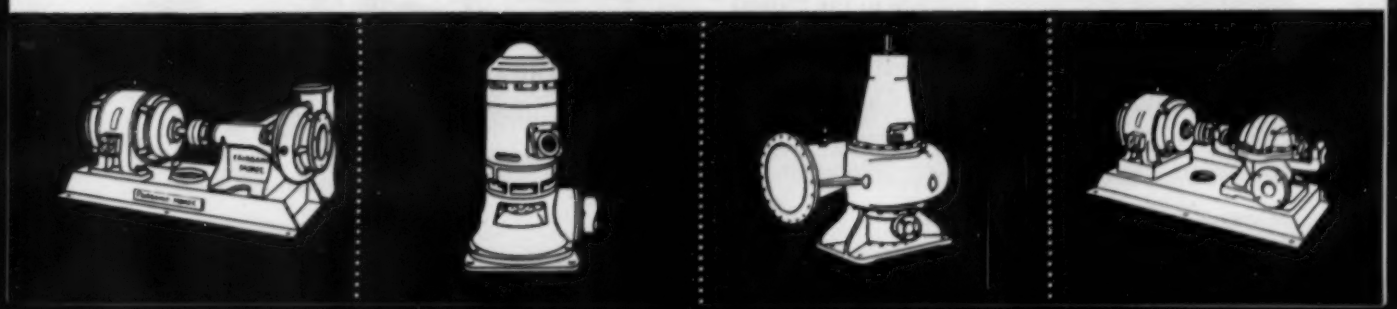
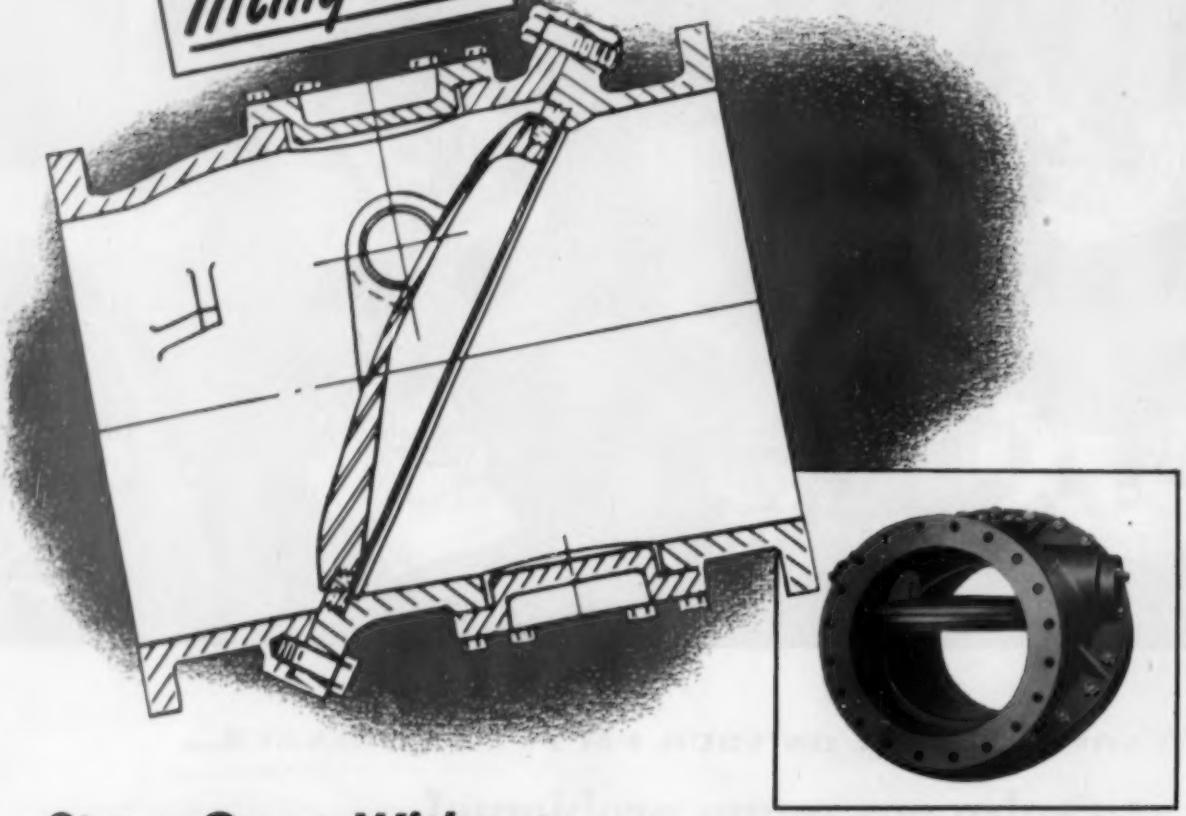


CHAPMAN'S

Tilting Disc CHECK VALVE



Stays Open Without Flutter, Closes Fast Without Slamming

Chapman's Tilting Disc check valve keeps maintenance costs down in the entire piping system. There's no flutter or vibration in the open position: the lightweight, airfoil-designed disc is held firmly against its stops by the fluid flow.

When flow starts to reverse, the uniquely designed disc swings quickly to the closed position, cushioned by fluid pressures, and then drops to a tight seal against the seat, without sliding or scraping. Closure is fast, tight . . . and *quiet*. Slamming is *eliminated*, in all but unusual piping arrangements.

Freedom from vibration and slamming, low wear and low head loss keep maintenance costs down, give years of more efficient service. For every check valve service, specify Chapman's Tilting Disc. Available in steel or iron, with suitable trim to meet service conditions. Full engineering data are in Catalog 30. Write for it today.

The Chapman Valve Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS

A HORTON ELEVATED TANK

for a new water system

When the influx of residents and visitors turned Hallandale, Florida, from a truck farming area into a tourist center, it became necessary to build the city's first water treatment and distribution system. Included in the city's new water system is a 200,000-gal. Horton® elevated tank that provides a reserve of water that will flow under gravity pressure to meet peak load periods and emergencies.

Write our nearest office for further information on a Horton elevated tank. They are built in capacities to 3,000,000 gals.

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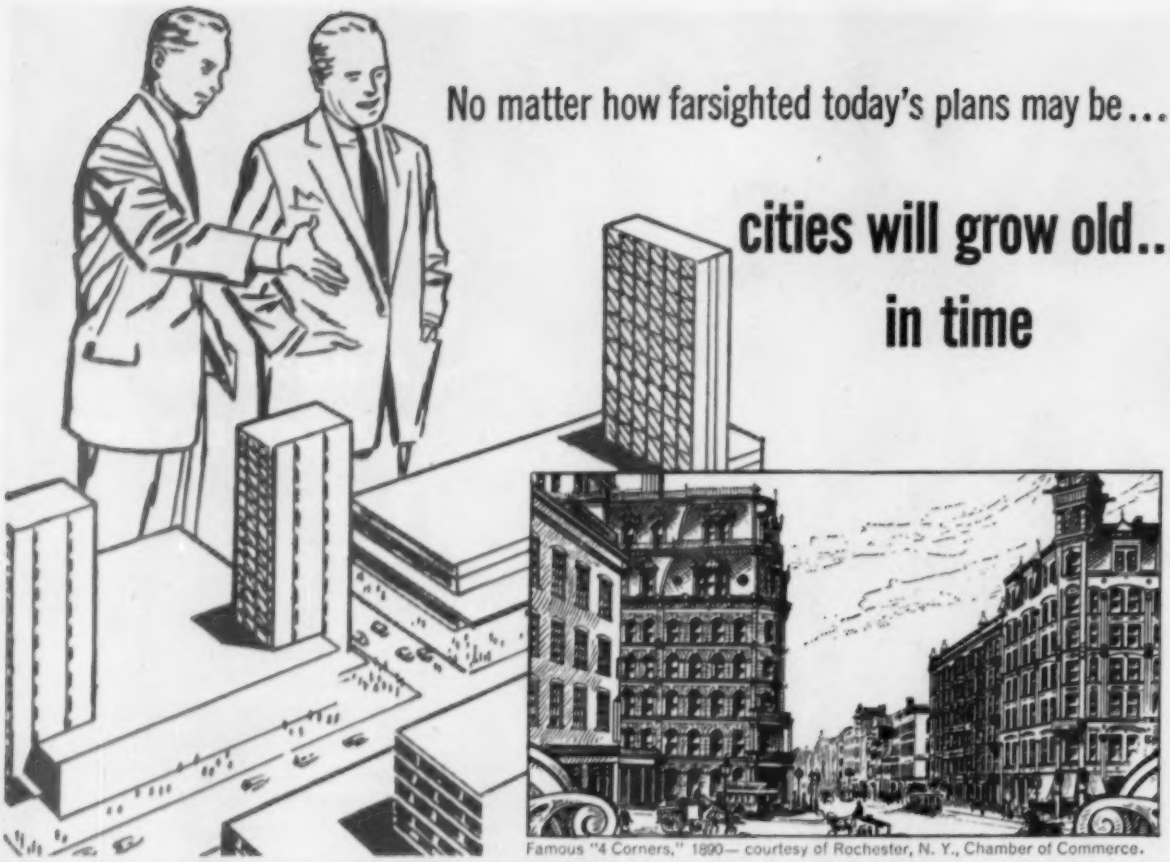

No matter how farsighted today's plans may be...

cities will grow old... in time

Famous "4 Corners," 1890— courtesy of Rochester, N. Y., Chamber of Commerce.

Your best insurance against obsolescence of your water system...

specify EDDY Valves and Hydrants *throughout*

No matter how far into the future your city planning is projected, Eddy's record testifies that Eddy Valves and Hydrants are your best long term investment. Eddy Valve Company's more than 100 years of dependable operation means that, today, you can get replacement parts for any Eddy Valve or Hydrant ever installed. And our ability to continue to do so is your assurance against future obsolescence of your valves and hydrants.

EDDY Bronze-Mounted HYDRANTS open smoothly *with* the pressure and close without water hammer. One man can easily remove all operating mechanism for inspection and repair. Positive drip action automatically drains the standpipe, safeguarding against freeze-ups. Stem held in place below hydrant valve means that there is no water loss due to a bent stem.

EDDY Bronze-Mounted GATE VALVES offer simplicity of design, trouble-free operation and enduring service. From the engineering drawing boards through all stages of manufacture, they are step by step a truly "finished" product of workmanship. These factors, added to personal experience, tell why progressive water works men have relied on Eddy for generations.

Eddy Hydrants and Valves are available with hub, flange or mechanical joint connections to fit any existing or planned installation.

Send today for full data on the complete line of Eddy Valves and Hydrants. No obligation.

EDDY VALVE COMPANY

A Subsidiary of James B. Clow & Sons

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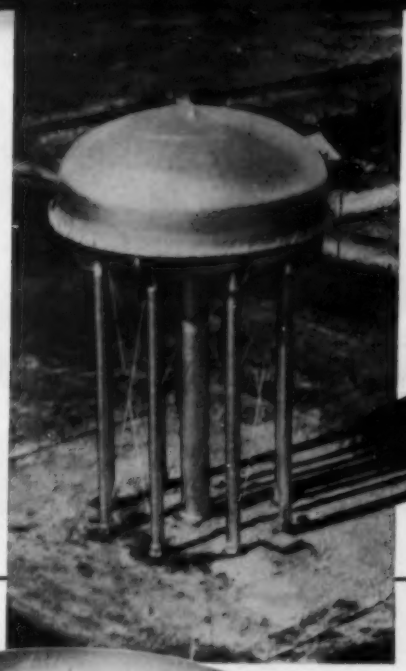

At *CORSICANA, TEXAS,* this Radial Cone Bottom PDM Steel Elevated Tank furnishes 750,000 gallons of water storage capacity, with a head range of 25 ft. Diameter is 73 ft.; tower height to bottom line, 81 ft.

PITTSBURGH • DES MOINES *Elevated* STEEL TANKS

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MODERN

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FINE-APPEARING

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an asset for any community

Your questions of cost, performance and suitability find satisfactory answers in the complete line of Pittsburgh-Des Moines Elevated Steel Tanks. The wide range of types and capacities covers the needs of town and metropolis with equal dependability. Write for your copy of our comprehensive "Modern Water Storage" Brochure—free on request.

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Water is vital...

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IN only one year, more than *26-million tons of paper* are required to fill the needs of the nation . . . to help business operate, to serve personal needs, to bring your daily newspaper to your door. Yet it takes *more water than wood* to produce this paper.

The Badger water meters used in America help save water for this vital need . . . measure water accurately for homes and industry . . . provide a precise check of water usage and waste. And they make certain that users pay fairly for the water consumed . . . help make water departments self-supporting.

As a result of their superior performance through the years, Badger meters are the favorites of waterworks men throughout the nation . . . famous as the meters that save water, work and money.

Badger Water Meters

Badger Meter Mfg. Co.
Milwaukee 45, Wisconsin

"Measuring the water of the world for 50 years"

NO CURE-ALL FOR SALE!

Experience with plating waste treatment has shown staff and consulting engineers that no one process or type of equipment is generally applicable to all problems. Thorough evaluation of the many factors involved is necessary in each case.

Whether the solution required is ion exchange or precipitation Graver has complete equipment to do the job.

Graver can offer you:

*Choice of either basic process and equipment

*Engineered flexibility to suit individual requirements

*Advanced equipment design proven in hundreds of installations

*Over 45 years' experience in the water and liquid treatment field

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WC-103 A — Reactivators • WC-111 — Ion-Exchangers
T-136 — Plating Waste Solutions — Recovery or Disposal
T-130 — Ion Exchange A Practical Tool in the Plating Room
T-123 — Applications of Ion Exchange to Plating Plant Problems

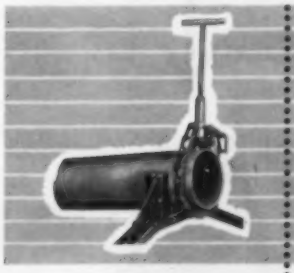
GRAVER

Industrial Waste Treatment Dept. W-113
GRAVER WATER CONDITIONING CO.
A Division of Graver Tank & Mfg. Co., Inc.
216 West 14th Street, New York 11, N. Y.

THE RIGHT TOOL SAVES TIME AND MONEY

LEARN ABOUT THESE SPRING LOAD MONEY-MAKERS!

Discover the time and money saving qualities of Spring Load Tools. See why thousands of plumbers and contractors, water and sewage department officials, public works department heads and others specify "Spring Load." There is a dealer near you . . . ask for a demonstration.



CAST IRON PIPE CUTTER

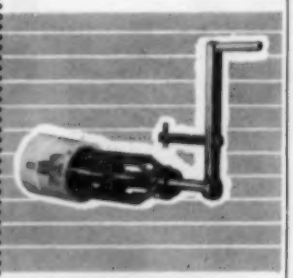
Cuts with equal pressure all around the pipe. No splits . . . no breaks . . . no spoilage. Even apprentices or helpers can cut pipe four to ten times faster than with old fashioned methods. Cuts Cast Iron, Duriron, Vitreous Clay, Water Pipe, Cement Sewer Tile.

ASBESTOS-CEMENT PIPE CUTTER

You get easy, fast and clean cutting on any asbestos-cement pipe with this on-the-job tool. Practical in the field, at the shop and on the stock pile. Field proved, this tool reduces cutting time 50%. Light weight—easy to use—no pipe spoilage.

GRAVITY GRIP VISE

The 10 second set-up for cutting pipe on the job. Adjusts in seconds . . . holds short or long pieces, bends and fittings. Sturdy, compact, easy to transport, the Gravity Grip Vise is a "must" in the shop and on the job.



SPRING LOAD TENON TOOL

For asbestos-cement or wood pipe field tenons to a factory finish. Machines tenons any length up to 6'. A one-man tool—adjusts in seconds. Close-tolerance cuts eliminate adapters. Light, portable, on-the-job tool.

All Spring Load Tools are unconditionally guaranteed against faulty workmanship or faulty materials.

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Man's most vital need, water, poses a problem to communities everywhere . . . population increases and industrial expansion have strained distribution systems to the limit.

Efficient WEINMAN Centrifugal Pumps are capable of . . . and deliver . . . continuous, reliable pumping service for any type of water distribution system, operating over long periods of time without major maintenance. A wide range of WEINMAN Centrifugal Pumps are available in models for both low and high heads, in single or double-stage, in capacities to suit industrial and civic requirements. A WEINMAN Centrifugal Specialist is no farther away than your phone; his expert knowledge will insure success in overcoming your pumping problems, large or small. Write, wire or phone.

WEINMAN TWO-STAGE SPLIT-CASE PUMP **for high head service—capacities up to 600 gpm. Single Stage types—capacities up to 4,000 gpm.**

Representatives in principal cities.

Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

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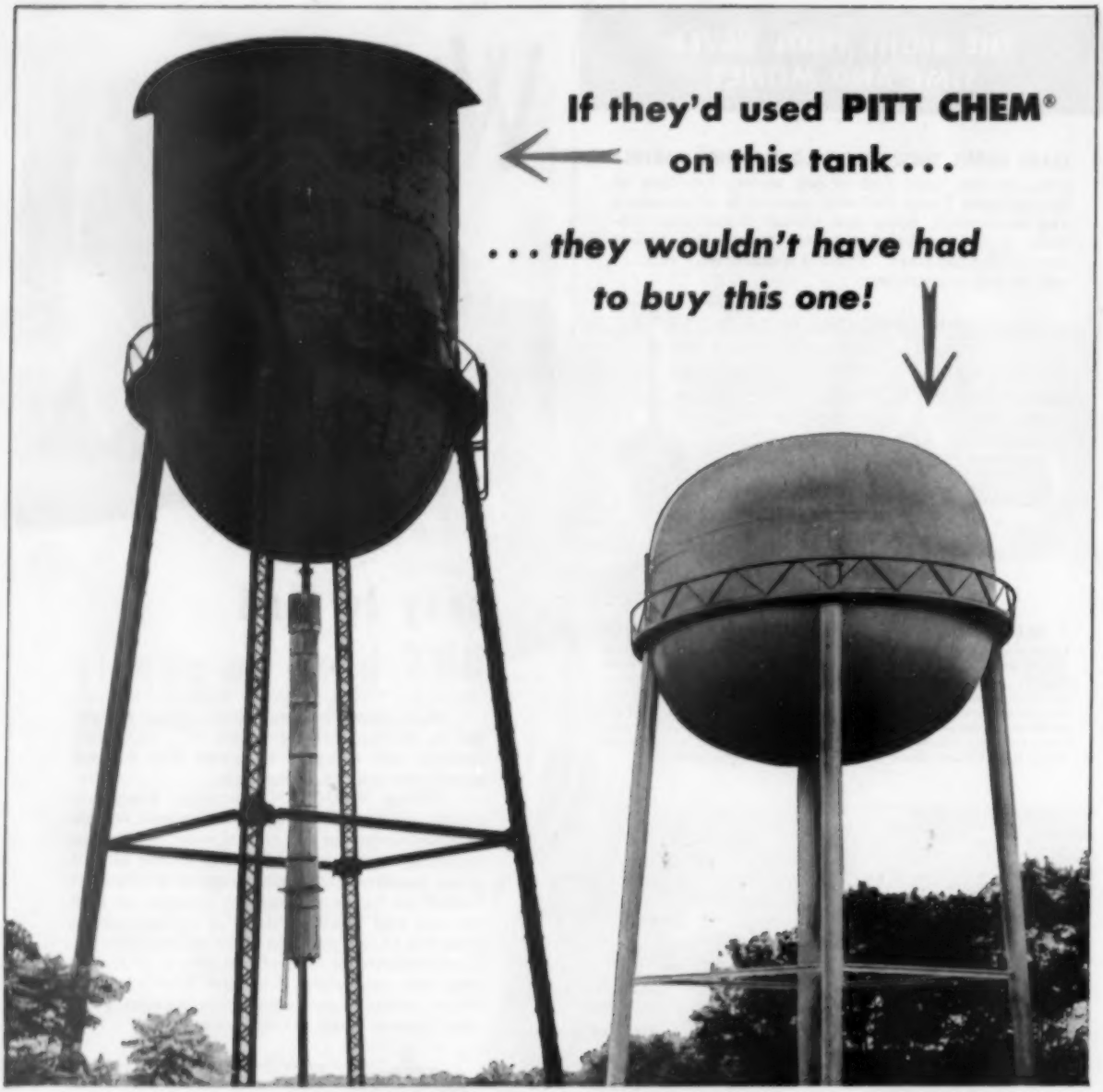

THEY TRIED to protect the water tank on the left with ordinary paint. That's why they had to recently erect its replacement on the right!

But *this* time they beat corrosion to the punch. A *Pitt Chem* engineer was called in prior to actual construction. Here's what he recommended: (1) Protect the tank interior with *Pitt Chem* 104—a tough, durable, water resistant coating that imparts no taste or odor to water. (2) Protect exterior tank surfaces with *Pitt Chem* 209 Alkyd Resin Aluminum Coating to combine attractive appearance with maximum resistance to atmospheric corrosion. (3) Protect the water pipe mains above ground and below with *Pitt Chem* 101, a thick, heavy duty tar base coating.

Thanks to *Pitt Chem*, the community is now assured of years of trouble-free service and maximum protection of their investment at minimum cost. Let us help you with *your* corrosion problems. ● Call or write today for technical information or engineering assistance.

PROTECTIVE COATINGS DIVISION
PITTSBURGH COKE & CHEMICAL CO.
Grant Building • Pittsburgh 19, Pa.

W&O 5525

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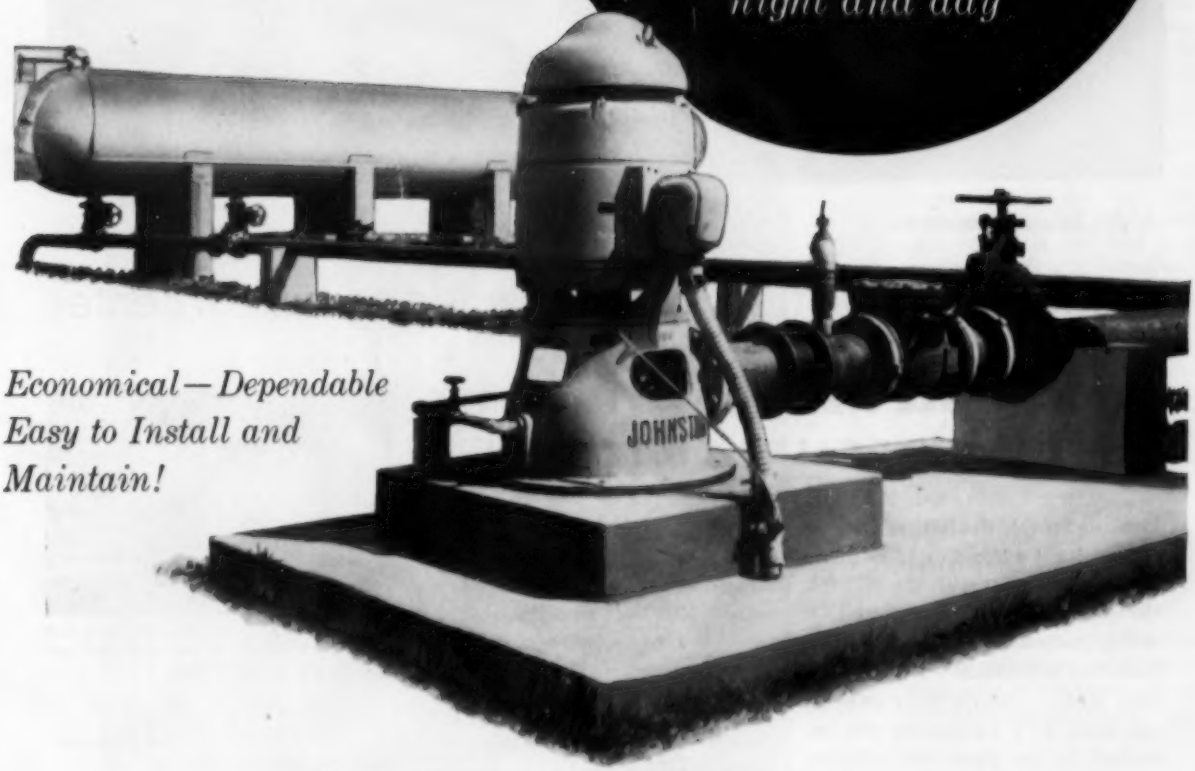
Wherever water is needed —you'll find

JOHNSTON
VERTICAL PUMPS

are on the job night and day



Economical—Dependable
Easy to Install and Maintain!

Municipal and county water engineers are among the shrewdest judges of pumps. They know from experience that water supply pumps must be designed to stand up under hard usage day and night, year after year, with minimum down time for repairs. Shown above is a Johnston Pump in use by the Fresno County Water Works District No. 7 —one of many typical Johnston water supply installations. Write for details.

JOHNSTON VERTICAL PUMPS

WSW-65

JOHNSTON PUMP COMPANY

Founded in 1909

Bin "K," Pasadena 15, California

☐ Kindly send colorful bulletin ☐ Have representative call

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Address_____

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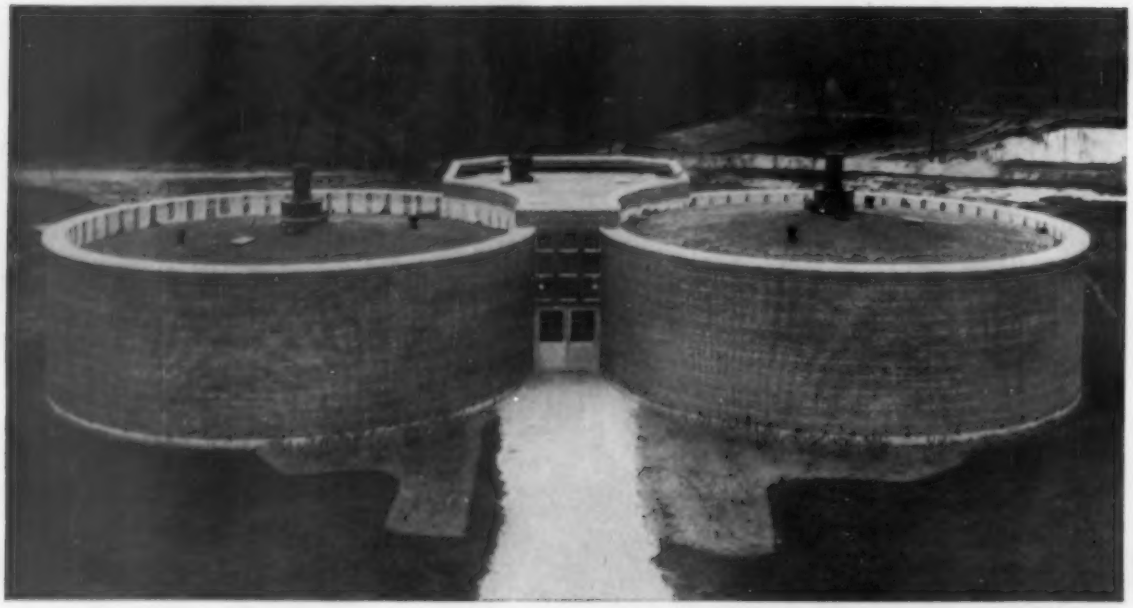
Rochester's two 50′ digesters, each equipped with PFT Floating Cover



At Rochester, Minnesota...

Modern sewage treatment for world's medical center

EXPANDABLE NEW PLANT INCLUDES PFT "CONTROLLED DIGESTION"

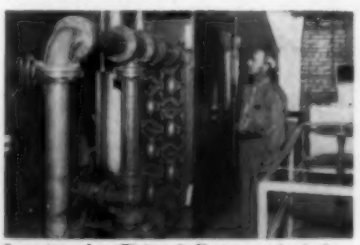
Looking far into the future, Rochester has built a trickling filter plant designed to grow with the city for the next 60 years! Completed in 1952, plans already call for additions that will handle 7 MGD by the year 2000 . . . nearly *twice* its present load. PFT equipment was installed in the plant for effective "controlled digestion."

A PFT Floating Cover is installed in each of the 50′ digesters for accelerated digestion and positive scum submergence. Operations are simplified because additions and withdrawals can be made at times best suited to the overall operation . . . no fixed levels need be maintained.

Breakdowns and repairs are materially reduced because Floating Covers contain no moving parts. Since no mechanical agitation is required, and heat is supplied from *external* heaters, all maintenance takes place outside the tank.

In the Control Room, a *PFT Heater & Heat Exchanger unit* (500,000 B.t.u. per hr.) maintains close temperature control of the digesters *automatically*. Fired by digester or city gas, it cuts fuel costs by utilizing all gas produced in the digesters. Effective "controlled digestion" is due in large part to this automatic heat control!

Congratulations to Rochester, medical center of the world, on its excellent new plant and its far-sighted planning.



Superintendent Walter C. Hogenson checks heat output of PFT Heater & Heat Exchanger unit in the digester control building.

Design of plant by / *Toltz, King & Day, Inc. St. Paul, Minnesota*

waste treatment equipment exclusively since 1893

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PACIFIC FLUSH TANK CO.
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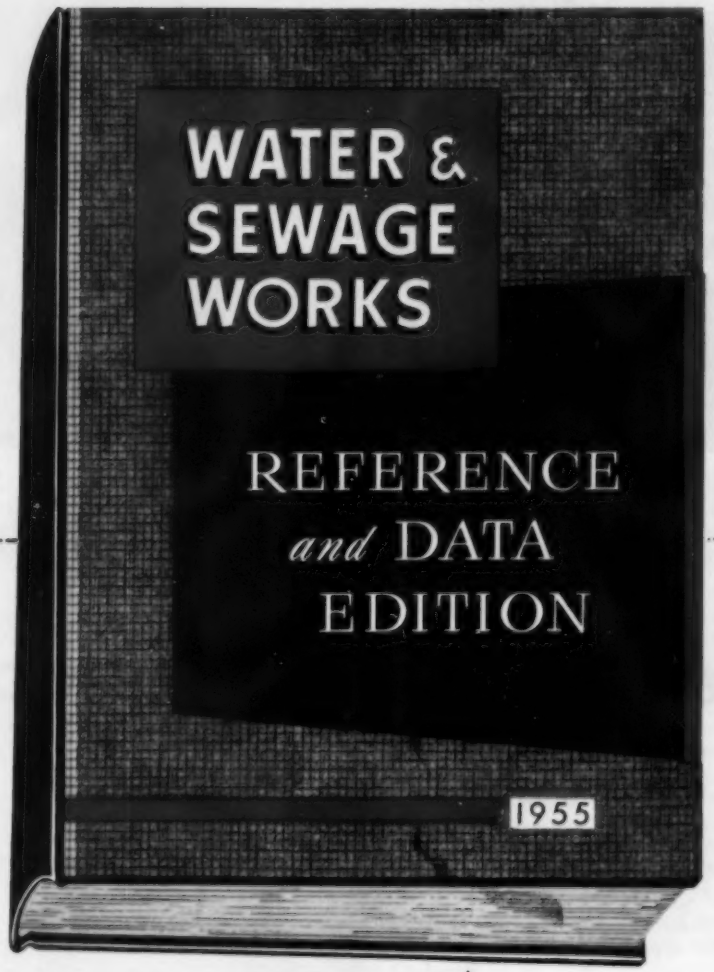

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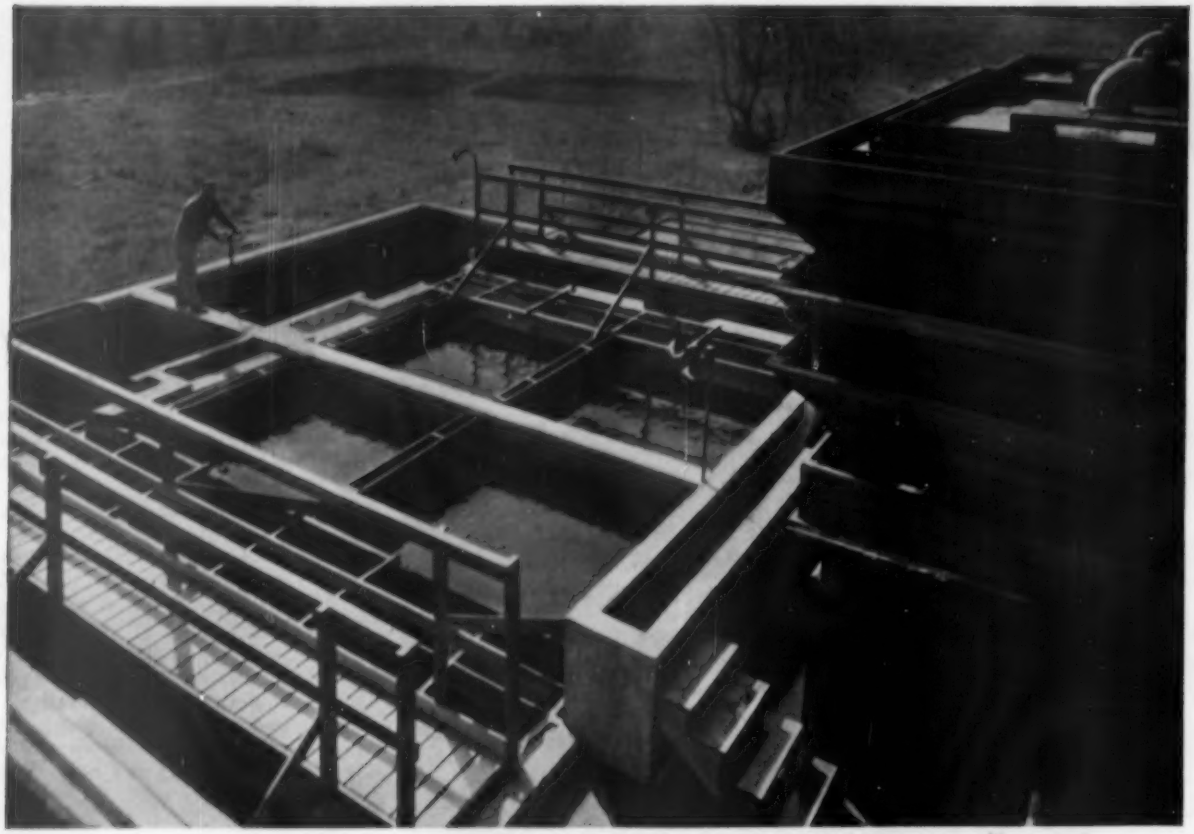

Raw well water with 30 parts per million of iron enters the double coke-tray Permutit *Aerator* (right) which oxidizes the iron and reduces CO_2. Next step is the Permutit *Precipitator* (left) where lime is added to raise pH and precipitate the iron . . . clay to thicken the precipitates. The resulting floc forms a suspended sludge blanket that speeds the chemical reaction . . . makes it more complete. Final treatment is by 5 Permutit Pressure Filters which remove remaining traces of precipitated iron and turbidity to deliver clear, iron-free effluent.

How *Fairless Hills* reduces iron from 30 to 0.14 ppm!

Fairless Hills, Pa., was built from the ground up to a community of 6,500 in less than 4 years . . . yet, because of good planning, there has never been a water supply problem. Before construction began, the search for water was underway.

The first test wells were disappointing . . . couldn't deliver enough. The nearest river water supply was too dirty and within the tidal basin. And when an adequate well water supply was discovered, it was acid and contained not just the usual few tenths ppm of iron but well over 30 ppm . . . 100 times the allowable standard!

Since even a few ppm of iron are considered difficult to handle, 30 parts presents a real problem. Because of the efficiency of its unique sludge-blanket design, a Permutit *Precipitator* was provided under specifications prepared by Consulting Engineer Howard A. LeVan, Jr. of Harrisburg, Pa. The unit was guaranteed to reduce iron to not more than 0.3 ppm.

"Now, the iron content is 0.14 ppm and the pH is 9.0. This equipment is doing a good job," reports H. D. Markle, Chief Engineer for the builders.

"In 29 years around the country, I've seen numerous Permutit installations doing a good job," adds Township Sup't. of Sewage and Water Supply, W. W. Willis.

It's easy to see why you should bring your water problem to Permutit. Address: The Permutit Company, Dept. W-6, 330 West 42nd St., New York 36, N. Y.

Water Conditioning · Ion Exchange

PERMUTIT

EQUIPMENT · RESINS · EXPERIENCE

how much does it cost... to have *Safest* CHLORINATION?

Nothing—when you buy a Fischer & Porter Chlorinator. That's true because fool-proof safety features are already engineered into this modern, instrument-type chlorinator.

> The F&P Chlorinator is instrument engineered from top to bottom to be absolutely safe in any emergency—and the safety features respond instantly. The mechanical design—without hydraulic devices to introduce time lag—make this a certainty . . .

In the F&P Chlorinator you can take a hammer and shatter the flowmeter tube—and the chlorinator shuts down *instantly*.

In the F&P Chlorinator you can pull the flow setting needle valve right out of its socket—and the chlorinator shuts down *instantly*.

In the F&P Chlorinator you can shut off the ejector water supply while leaving the chlorine on—and the chlorinator shuts down *instantly*.

In the F&P Chlorinator a simple series of hand manipulations tests each safety component—or shows the reason for malfunctioning should it ever occur.

These safety advantages are yours in the Fischer & Porter Chlorinator. They cost you not one penny more at the outset, since the F&P Chlorinator is lower in first cost. They avoid constant costs of repeated safety tests and checks. They assure you against high costs of repairs and maintenance. We don't put our safety devices under a bell jar—they are right out in the open where you can see and touch them.

These engineered features—*instrument-type engineering*—make the F&P Chlorinator the safest ever built. And you get all these safety features *plus* ease of operation, dependability proven in over 600 operating units, complete corrosion resistance—everything you should have in a chlorinator—and you get them for even less cost in the initial purchase. Write today for full information, details on free trial offer, and *absolute guarantee of satisfaction.*

complete process instrumentation

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MODERNIZE AS YOU REPAIR

. . . at only a fraction of the cost of new meters

It's easy . . . and a proved economy . . . to keep your Trident water meters up to date. Parts made for modern Tridents, embodying every thoroughly tested advancement known to the science of metering, are designed to fit into any Trident water meter of the same size and type . . . no matter how old. Every time you replace worn parts with genuine Trident parts, the meter's ready for many more years of accurate service . . . at only a fraction of the cost of scrap-and-replace programs.

No need to keep complicated stocks of parts for many models. Just keep the latest Trident parts on hand. Reordering and stock control are simple, and your meters never become obsolete. Training service men is easy, too. Not only is the Trident extremely simple and virtually fool-proof, but also your service men need learn only one model.

This 50-year policy of Trident is your best assurance that the meters you buy today will earn maximum revenue for your utility . . . with lowest yearly costs . . . for many years to come.

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WATER & SEWAGE WORKS

VOL. 102, NO. 7 • A Scranton Gillette Publication • JUNE, 1955

EXPANSION—New buildings for pumping units (left) and filter units (right) added to the R. B. Simms Filtration Plant

Spartanburg Plans for the Future

This South Carolina city installs pumps, filters, and pipe lines to meet expanding needs for municipal and industrial water

by R. B. SIMMS and W. C. BOWEN

Mr. Simms is Superintendent, and Mr. Bowen is Engineer-Chemist of the Spartanburg Water Works, Spartanburg, S. C. Their article was edited by Mr. H. F. Wiedeman, Wiedeman and Singleton, Engineers, Atlanta, Ga.; Mr. R. C. Kauffman of the same firm has drawn the illustrative map of Spartanburg County.

THE PIEDMONT area of South Carolina has experienced a rapid industrial growth in the past few years, and all indications point to future continuation of that growth. As a consequence, there has been a phenomenal increase in the use of water both for industrial and domestic purposes. Wherever municipal water supply lines are laid, one soon notices the development of residences and community centers.

In keeping with its historic policy, the Spartanburg Water Works has planned ahead and kept pace. This policy might be epitomized as "When the demand comes the water is available". During the war years, when material was scarce and labor not available, funds were accumulated. Plans were mapped out at that time by the management and the consulting engineers for an orderly development of the system when peace came.

The National Board of Fire Underwriters made a survey of the city in 1952. The underwriters' report requested that additional pumping capacity be installed at a higher elevation to prevent interruption of operation by pump room flooding.

The original pump room was built at clear well level, so as to provide a positive suction pumping head. In 1945 a suction well was constructed, adjacent to the pump building. It was decided that two Layne vertical turbine pumps could be placed over this suction well at the upper floor elevation. Two pumps, of 4,650 gallons per minute capacity each, were installed in an addition to the existing building. The architecture of the addition matches that of the power house and filter plant. These turbine pumps are operating against a head of 290 feet, being connected to the force mains with a 20-inch diameter steel header. Flow is controlled by S. Morgan Smith cone valves.

At the time this construction was carried out, the capacity of the chemical storage warehouse was doubled. This entire project cost $120,000 and was paid for from accumulated funds.

New Filter Capacity Constructed

Water pumpage having reached a peak of 10 to 13 mgd in 1953, plans were made to increase the 9-mgd filter capacity to 12 mgd. The design included an additional filter building with two filter units, each of 3-mgd

CONSTRUCTION—*Start of second steel transmission main in 1954: Left to right are H. F. Wiedeman, Consulting Engineer; Frank Rushton, Armco Steel Pipe; R. B. Simms, Superintendent; and E. A. Deconynck, Contractor*

capacity. One filter is not to be loaded until future demand indicates it to be necessary.

The filters are of sectional wash design, using sand as filter media. The filter effluent is piped into the existing clear well, in order to eliminate duplication of chemical feed equipment. An additional 300,000 gallon wash water tank was built on high ground near the plant. The cost of this addition, financed from revenue funds, was $200,000.

At about the same time, a bottleneck in transmission mains became apparent, especially during summer peak loads. Studies were made by the management and the consulting engineers as to the best means for breaking this bottleneck. A preliminary study indicated that a new 24-inch force main and a 30-inch gravity supply main would serve the purpose. Since two existing mains followed the highways from the plant to the city, and there was no room for a third, it was decided to run the new line across country to enter the eastern side of the city. Air photos were used to lay out the new line, and then this line was transferred to the ground by survey. The route lies well away from the existing lines, thus providing some measure of protection from the civil defense viewpoint.

Bids were taken on three types of pipe: cast iron, steel and reinforced concrete. The steel pipe proved to be the lowest bid and was accepted. The water works purchased the valves and pipe and a construction contract was let at the same time.

Financing by Revenue Bonds

The cost of this line was such that it was necessary to do the financing by revenue bond issue. Preliminary steps were taken, and $1,000,000 worth of revenue bonds were sold at an interest rate of 2.34 per cent. The bonds were given a rating of Aa, the highest rating to date given to the water works bonds of any city in South Carolina. The bond issue is of open-end type so that additional issues may be made in the future under the same terms and conditions.

In order to carry the bond issue, it was necessary to increase water rates about 11 per cent. This rate increase was the first that has been made by the Spartanburg Water Works since 1917. A minimum rate of $1.00 net was set, and the new rate schedule went into effect December 1, 1953.

The route of the 30-inch line lay through open country, traversing peach orchards, pastures and crop lands. The right-of-way was given without cost except for agreement to provide a tap for the landowners. Four-inch spigots were welded into the steel pipe at intervals to provide these services and as outlets for irrigation, a growing practice in this area. The water consumed will be paid for by the users at regular rates.

A tunnel was driven under Federal Highway 29, an important north-south artery, and the pipe was laid without traffic interference. The tunnel was constructed for the contractor by Armco field crews.

The pipe used is Armco spiral welded, 24-inch and 30-inch ID, ¼-inch thick steel. It is lined with bitumastic Koppers 70-B coating, the outside being coated with the same material and wrapped. Dresser couplings were used throughout to couple the fifty-foot pipe sections, as well as smaller lengths and fittings. Crispin air valves were used on high points and six-inch blowoffs were provided at low points. The engineers and the management never hesitated to accept steel design because of past experience with such lines, Spartanburg originally having laid steel pipe of 20- and 24-inch diameters in 1939.

New Main Laid in Stages

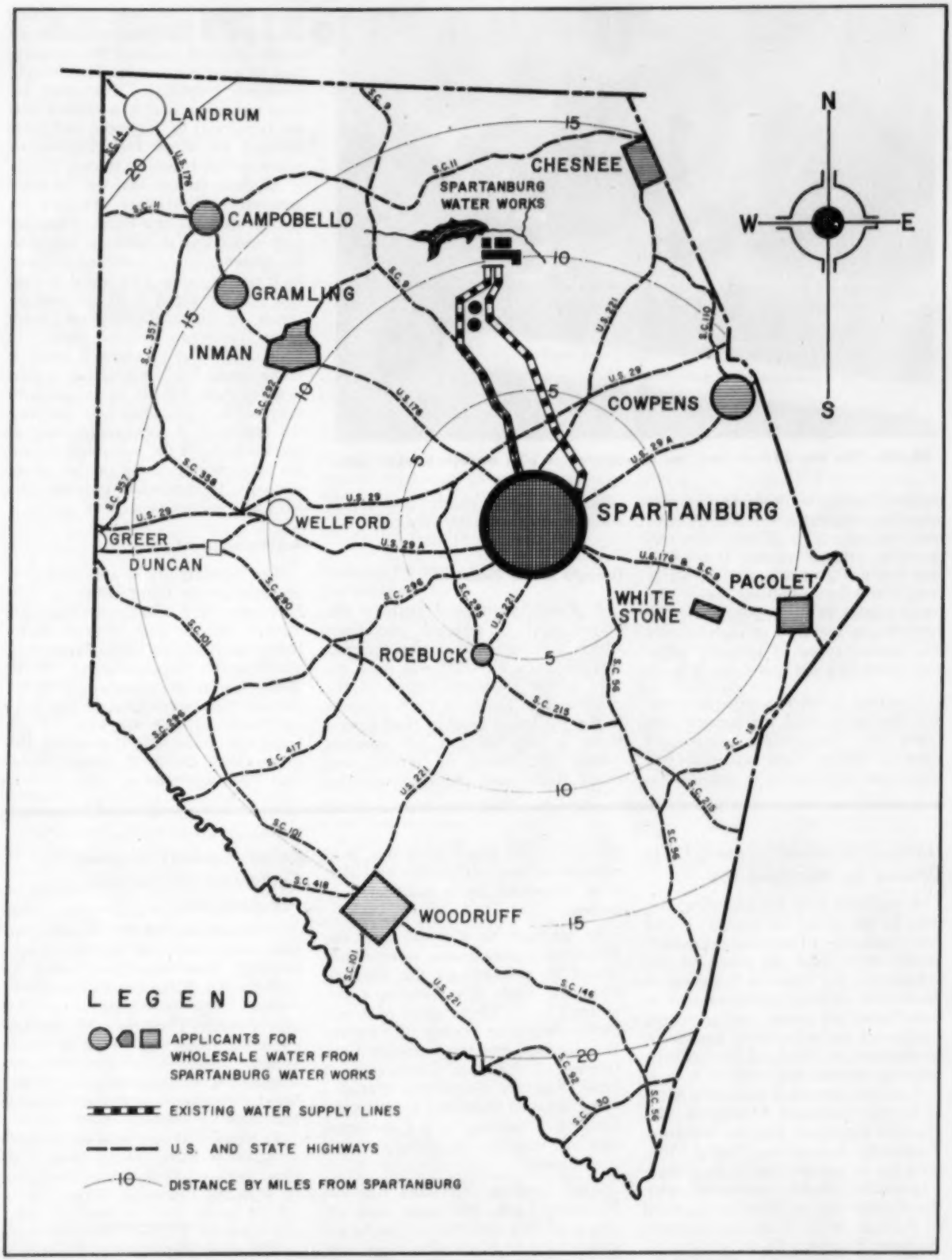
It was decided to build the new line in three sections or stages. The first section was 35,500 feet of 30-inch diameter pipe, laid from the existing clear water storage reservoirs to Highway 221. The second section was 16,000 feet of 24-inch force main, laid from the plant to the reservoirs and connecting to the 30-inch. These two stages will shortly be completed. The third section is to be laid from Highway 221 to a point on East Main Street.

In order to keep within the bond issue, the third stage will be constructed in the future. The second stage will be connected to the distribution system at the old pump plant (on the northern edge of the city) by a 20-inch cast-iron pipe line, laid along Highway 221 for a distance of 9,000 feet. When the third stage is built, a 24-inch cast-iron main will connect it to the downtown municipal area along East Main Street. It is considered that this transmission main program will suffice for some time to come.

Factors in Future Planning

Among many factors upon which future planning for the water works is premised, three or four are outstanding at present. One factor is the growing demand, by small towns and communities within Spartanburg County, for water service from the Spartanburg Water Works. Legislation was enacted at the 1954 session of the South Carolina General Assembly, creating water districts, radiating from the city along major highways and rail lines to the towns of Woodruff, Pacolet, Cowpens, Campobello and Inman (see Fig. 3).

At the present session of the legislature other measures have been in-



SPARTANBURG COUNTY MAP—Treating water from Rainbow Lake, the Spartanburg Water Works supplies the city ten miles to the south. 1954 legislation created water districts to include small towns and communities, of which Spartanburg is the hub.

PILING—The new 24-inch steel line is supported on piles through Rainbow Lake

troduced setting up other districts and amending present laws. Boards have been organized, and engineers retained to present reports. It is probable that in the near future the water works will be supplying these districts similar to its neighbor, Greenville. There are sites in each district for various types of industry adjacent to the highway and railroad lines.

A second factor is a movement under way to expand the present city limits of Spartanburg, unchanged since the 1880's. These extensions will necessitate strengthening present distribution system mains, and laying additional mains in the annexed areas.

Drought in the Piedmont

A third factor, and perhaps the major one, is drought conditions which have occurred during the past several years. Drought was most severe in the Piedmont region of the Southeastern States in 1954. Streams in the Piedmont reached their lowest flows in the fall and late summer (many the lowest of record) and many towns and cities experienced water supply problems. Spartanburg asked for a volunteer reduction of water use and received the cooperation of most consumers. The drought condition emphasized the need for crop irrigation, and it is evident that the trend will be for more and more demand for water for irrigation of peach orchards and pastures.

All these factors have led the management to instigate studies for sources of more raw water. Plans are well under way to raise the height of the present dam by installing five foot high tainter gates. The added storage will provide about a 50 per cent increase in the available raw water from the South Pacolet River. In addition to that measure, a study is being made for constructing a dam and reservoir farther upstream to be operated in conjunction with the present reservoir. A topographic map of certain parts of the watershed is now in preparation, using aerial photo methods, to determine possible dam sites and storage capacities.

Acknowledgment

The Spartanburg Water Works is operated by the Commission of Public Works; R. E. Stallings, Chairman, Taylor Blalock and DeFoix Kirby being the present Commissioners. R. B. Simms is Superintendent, M. B. Mills, Secretary-Treasurer and W. C. Bowen, Engineer-Chemist. The firm of Wiedeman and Singleton of Atlanta, Ga., have been Consulting Engineers since the R. B. Simms Filtration Plant was built in 1926.

National Standard Plumbing Code Offered for Municipal Use

A uniform code for plumbing has been approved as the country's first true national plumbing standard. After more than 20 years of development, the code is designed to modernize existing practices and to coordinate the work of plumbing equipment manufacturers, architects, contractors, municipal law makers, building officials and others.

The announcement was made jointly by the American Society of Mechanical Engineers and the American Standards Association. The ASME, with the co-sponsorship of the American Public Health Association, provided leadership in obtaining approval of the code as the American Standard National Plumbing Code.

The ASA stresses the fact that the code is not mandatory. It is "national" in the sense that it is distinguished from the multiplicity of different codes which have only local recognition and acceptance and that it is supported by a national consensus.

In addition to the sponsors, the following organizations were represented as members of the National Plumbing Code Coordinating Committee: U. S. Department of Commerce, American Society of Sanitary Engineering, Building Officials Conference of America, Conference of State Sanitary Engineers, National Association of Plumbing Contractors, Uniform Plumbing Code Committee, and the Western Plumbing Officials Association.

The American Standard National Plumbing Code, 186 pages, is available at $3.50 a copy from: The American Society of Mechanical Engineers, 29 West 39 Street, New York 18, N. Y., and the American Standards Association, 70 East 45 Street, New York 17, N. Y.

Kansas Sanitary Engineering Conference Transactions Are Available

"Transactions of the Fourth Annual Conference on Sanitary Engineering" have been published as Bulletin No. 30 by the University of Kansas. The four papers included are: Sewage Treatment by the Lagoon Method, Plastic Pipe in Public Water Supply Systems, Aeration Theory and Its Application to Water Works Practice, Legal and Financial Problems of growing cities.

For copies of this bulletin, address T. DeWitt Carr, Dean, School of Engineering and Architecture, Univ. of Kansas, Lawrence, Kan.

The water department of Kalamazoo, Mich., maintains all water meters and service lines *up to the meter* at no charge to the customer. Waukesha, Wis., also does the same.

The Benefits of Effective Metering

In critical water supply problems, metering is essential to conservation

By MORRISON B. CUNNINGHAM

Mr. Cunningham is Supt. and Engineer, Water Dept., Oklahoma City, Okla. This article is a digest of statements presented by him on March 30, 1955, before hearings of the U. S. Tariff Commission and Committee on Reciprocity Information in Washington, D. C.

EFFICIENT USE of water meters is generally conceded to be one of the most effective means of operating a well-run water supply system. Certainly metering is an essential element in furthering the conservation of this vital commodity—particularly important in an era of increased demand and widespread shortages.

The design, metals, workmanship, operation and maintenance of water meters have been of special interest to me, not only in my own city, but many places in the United States. As president and vice-president of the American Water Works Association for the past three years, I have met with water works men in many sections of the United States and discussed our mutual problems, including those relating to water metering.

The proposal to grant tariff concessions on foreign-made water meters is a matter of great consequence to the water works industry. In my opinion, such concessions would be a threat to the most efficient and practical means available to water works and the nation to reduce water consumption and to thereby control the increasingly critical national water supply problem.

I will attempt to show the basis for this opinion by outlining (1) the relationship of meterage to supply; (2) the double threat to adequate parts supply inherent in tariff concessions, to wit, (a) the dangerous dependency upon foreign parts which would result, and (b) the likelihood that our domestic source of parts will be destroyed by foreign prices; (3) the likelihood that present essential services in constructing meters suited to local waters and in advising on the proper adjustment and maintenance thereof would soon be eliminated, or at least greatly reduced, by domestic meter manufacturers and, since not required under competitive bidding, would not be provided by low-price foreign meter suppliers. Their service is not the heart of the bidding, but it is a service that they include in their price schedule on the competitive bidding.

The fourth point is the inability of municipalities under local laws to protect themselves from these detrimental effects of low foreign bids which, in the long run, threatens the continuance of effective water metering in this country.

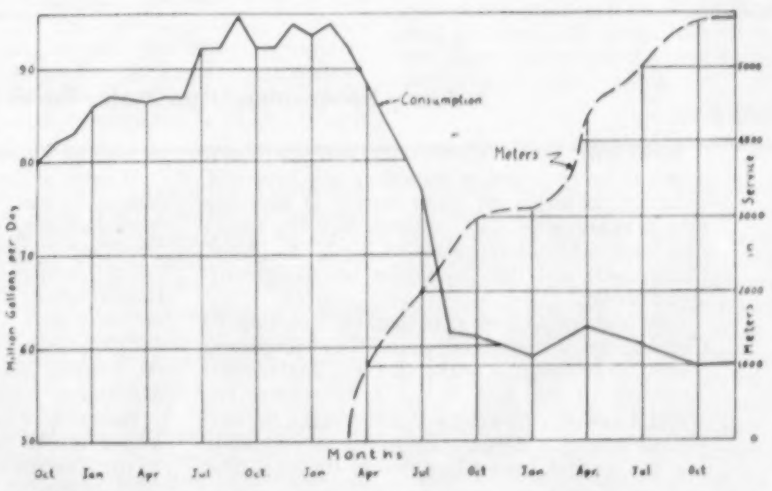
Metering Efficiently Reduces Consumption

It is universally recognized by water works officials that metering is the most efficient method of reducing consumption and encouraging water conservation. Each customer pays for what he uses on this basis. This practice ends needless squandering of water and encourages the fixing of the leaks which waste water. It is generally recognized that with the use of a water meter, 50 per cent of water consumption is saved.

Without the use of water meters, the actual needs of a community would be doubled. Therefore, it would be next to impossible to finance the construction of water supply systems—and not only these systems but other enormous investments such as filtration plants, pumping stations and distribution systems which would become necessary without adequate metering. The distribution system represents, on the average, about 75 per cent of the total investment of the water system.

I might say at this point that to find additional water supplies has become increasingly expensive and, in some locations very difficult. It is a real problem and an expensive one, especially in areas where water supply is of great importance.

To show the importance of water meterage, I should like to review the



EXHIBIT—This graph of the relationship between metering and water consumption (Water & Sewage Works, May 1954) was among exhibits submitted to the Commission.

METER TESTING—A meter testing shop at Van Nuys, Calif., illustrates equipment employed in this necessary routine practice.

present water supply situation and the increased demand for water. Increased consumption of water and the expanding requirements of industry have made the conservation of the nation's water supply a problem of national importance.

In our opinion the use of water meters is the best way and about the only way we can enforce water conservation.

The value of the meter industry of the United States, in peacetime as well as in time of war, is playing an important role by providing skilled workmen and plant facilities for the construction of water meters: water meters properly designed with proper metal alloys to meet the variable qualities of water, and workmanship which in addition furnishes a ready supply of inter-changeable repair parts available to the water departments.

Savings from Accurate Metering

I started to work for the Oklahoma City Water Department in 1920. My first assignment was to investigate the factors causing the sale of only 46 per cent of the water that was pumped into the distribution system. One of the contributing factors was found to be that the city had not availed itself of the services offered by the meter industry with respect to advice concerning water meter maintenance and the availability of repair parts.

Consequently, a large number of the meters were out of service and in many instances the customer was paying an estimated, or flat rate, bill. The cooperation and services of the water meter industry, the training of meter repair mechanics, consultations on making repairs and the availability of interchangeable repair parts, made it possible for us to recondition some 12,500 meters in 1920 and 1921. The result was an increase in the sale of water to 80 per cent of the water pumped. That represented a considerable saving.

The use of water by city departments was metered even though they did not pay for water. We found the city's use to average about 10 per cent, and we have since maintained the water meters in the system to where the unaccounted-for water amounts to only three to five per cent of the water pumped.

We have maintained close consultation with the meter industry and their representatives to the extent that by observation of design, metal alloys and workmanship, the quality and dependability of water meters have

Industry Spokesmen Urge Meter Tariff Retention

Spokesmen from various sectors of the water works industry joined in protesting any proposed reduction in tariffs on water meters at hearings held in Washington, D. C., March 30, 1955. Hearings were held before panels of the U. S. Tariff Commission and the Committee on Reciprocity Information.

Oral statements were presented by Morrison B. Cunningham, Superintendent and Chief Engineer, Water Department, Oklahoma City, and former President of the A.W.W.A.; J. G. Carns, Jr., Meter Engineer, American Water Works Service Co.; Dante E. Broggi, President of Neptune Meter Co.; and Jesse Climenko, of the legal firm of Gallop, Climenko and Gould.

Written affidavits were submitted by Francis P. Hersey, Vice President and Treasurer, Hersey Manufacturing Co.; Joseph E. Johnston, Vice President Badger Meter Manufacturing Co.; Robert R. Anderson, Vice President, Worthington Gamon Meter Division; Paul McHale, President of Local 1833, United Steel Workers of America (CIO); Otto Yoost, Committee Chairman, Local 66, District No. 10, International Association of Machinists' Union.

Harry E. Jordan, Secretary of the American Water Works Association, submitted a resolution by the Executive Committee of the A.W.W.A.

increased their efficiency about four times over the 1920 figures. For example, in 1920 we required four meter mechanics and four servicemen in the field, each with a car, to maintain 12,500 meters. Today, we have 79,600 water meters, with three meter mechanics and three field servicemen.

I think that is an example of the close cooperation of the water works people working with the manufacturers in using a standard specification, a general specification, and then going into special detailed requirements of metals to fit a particular water need. That was certainly true in our case.

Quality Meters and Good Service

I would like to give you a few examples of what I mean by the quality that goes into a water meter which is needed to give good service, free of unnecessary and expensive field maintenance and shop repairs.

The material, metals and parts of the design which applies to the water of Oklahoma City does not necessarily apply to a town 25 miles away, because each water supply has its own individual water characteristics. A town that has a water of even temperature (like well water or a supply outside the low-temperature zones) can get a close tolerance, but a town where there is a wide range of temperature, from above freezing to 80 to 90 degrees, must have more clearance. If there is inadequate clearance between the disc and the disc chamber, expansion will occur, the meter will stop, and the customer will get a prorated bill.

The meter manufacturers, through their field offices and local representatives, have over the past 50 years built up valuable service organizations, which are made available to the water departments of communities in the United States, without charge. The meter industry has available the services of metallurgists who are experienced in the behavior of metals in water.

Meter Manufacturers Are Specialists

Even the larger water departments would have difficulty in independently financing this type of consultation. When we stop to think that there are 16,000 water departments in the United States, serving more than 100,000,000 people with water, and that eighty per cent of these departments serve communities of 2,500 or less, we can see how it would be natural for the water works people to depend to a very large extent upon the valuable experience of the water meter industry representatives.

We depend on them to keep advised of the local water conditions in order to supply water meters of the best quality design, metal alloy and workmanship, to meet the local demand for a meter having a long useful life, relatively free of expensive field and shop maintenance.

It has been my observation that it takes years of experience and judgment for anyone to observe and determine metals that give good service and those that do not give good service.

I cannot conceive of a foreign-made meter company furnishing a meter to the water works industry of the United States which could meet these existing demands. Nor can I conceive of a foreign meter exporter having the incentive or the particular experience with American waters to duplicate these existing special services and know-how of the American meter industry, at least within the foreseeable future.

Domestic meter manufacturers provide and participate in extensive advisory and educational services relating to meter maintenance and adjustment. Field representatives of the meter manufacturers of the United States have participated in Water Works Short Course Schools which are conducted annually in most of the states, and District Meetings and Special Schools, such as those for the study of water meters, are conducted one or more times annually in many of the states. Representatives of the meter manufacturers always take an active part in this work.

Potential Danger in Foreign Supply

To sum up, let me state that, as a practical matter, the price advantage which a tariff concession would give to foreign meter companies would assure their obtaining water works business on a very large scale within a relatively short period of time. These foreign meters, so purchased, would in time of war or whenever the foreign manufacturer decides to go out of business or abandon their American market, become unusable or "dead" meters.

In addition, the destruction of or substantial injury to the domestic meter industry resulting from foreign competition would drastically impair and ultimately eliminate parts replacement for the thirty million odd American meters—that represents at least an investment of $400 million, and the replacement would be calculated at least double that amount or more —now in use as well as the other services in proper construction and maintenance of meters which are presently available only because American meter companies can presently afford to provide local water works and are, in my opinion, essential to truly effective metering.

I have no doubt that a market torn between indifferent foreign exports and a dying domestic industry can, in the short run as well as in the long run, produce only great hazards to our water works industry and to effective water conservation.

W&SW

North Carolina University Has Sanitary Engineering Contract In Peru Totalling $185,000

According to an announcement from Daniel A. Okun, Acting Head, Dept. of Sanitary Engineering, the University of North Carolina has entered into a three-year contract with the Institute of Inter-American Affairs of the United States Foreign Operations Administration for the purpose of strengthening the sanitary engineering educational and research programs in the National School of Engineering of Peru. The contract, which will call for the expenditure of some $185,000, will be administered by the University's School of Public Health through its Department of Sanitary Engineering.

The following members of the staff of the Department of Sanitary Engineering will go to Peru for varying periods of time during the first year: Professor Emil T. Chanlett, who will specialize in the field of environmental sanitation; Professor Marvin L. Granstrom, who will set up the Sanitary Chemistry and Biology Laboratory; and Professor Daniel A. Okun, consultant on sanitary engineering.

Faculty and engineers from Peru will also come to the United States under this project for special training so that they may return to Peru and continue with the developments initiated. There are at present two Peruvian engineers enrolled in the Department of Sanitary Engineering at the University of North Carolina: Miss Alcira Florez, who will return to Peru to serve in the Sanitary Engineering Laboratory of the National School of Engineering; and Mr. Alfonso Zavala, Engineer with the Servicio Cooperativo Inter-Americano de Salud Publica.

Design of Water Clarifiers and Softeners

Operating factors affecting the dependability and economy of equipment

by V. J. CALISE

Mr. Calise is Technical Director of the Graver Water Conditioning Co., New York, N. Y. His paper has been prepared to emphasize the need for good engineering and intelligent selection of equipmet to meet specific applications of these units in water clarification and cold process softening.

THOUSANDS of conventional water treatment plants which include units for flash mixing of chemicals and for flocculation followed by sedimentation have been and are still being installed in municipalities throughout the country. There is now, however, a strong trend towards use of so-called "high rate" solids contact units which produce comparable quality of treated water in shorter time and, consequently, at lower installed cost.[1]

Conventional processes do have a place in the kit of the municipal design engineer wherever conditions of load and operation, climate, and raw water quality dictate their need over "high rate" plants. The practical approach is to have both plant designs available, and to use whichever design is found to be most suitable to the specific conditions confronting the consulting or staff engineer.

Historical Derivation of Modern Units

The so-called solids contact units, in which cold water is continuously softened or clarified, were developed from batch treatment processes employed in water treatment more than 100 years ago.

Many such batch treatment processes are employed throughout the world today and are subject to the same problems experienced many years ago when the transition from batch treatment to continuous treatment started. These problems revolve about the fact that the chemical-precipitating reactions which take place at cold water temperatures are completed very slowly, even with large excesses of chemical reagents. It was found that:

(a) Large retention tanks are required for treating sizable quantities of water, to obtain fairly complete chemical reaction and proper settling of solids; and,

(b) Incomplete chemical reactions

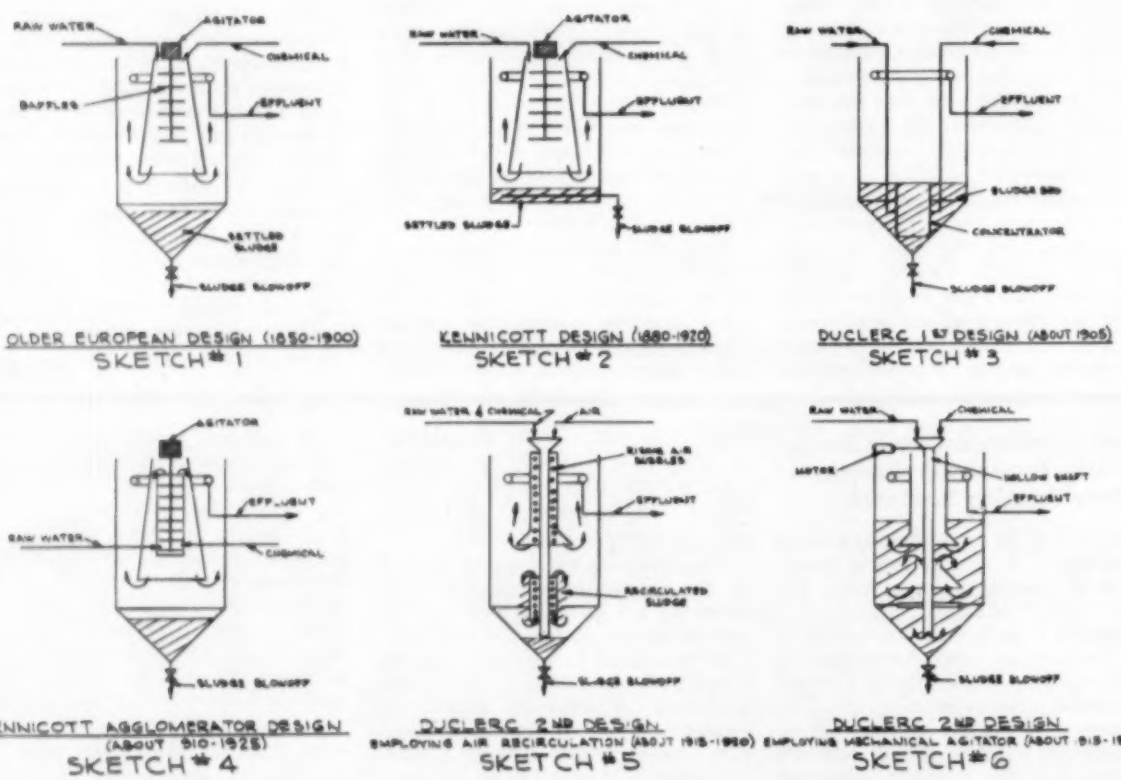


Fig. 1—EARLY TYPES of continuous treatment units, comparative details

and high turbidity are obtained—even with agitation and settling periods of four to six hours, and with large excesses of chemicals.

The change from batch to continuous treatment was stimulated mainly by the need for equipment smaller in size and lower in cost. Efforts were made to employ well-known chemical and physical principles in designing continuously-operating cold process chemical precipitation units for treating water. For example, after proper mixing of water and chemicals, it was found necessary to employ low upward settling velocities through relatively great heights in order to settle out precipitated solids. Also, attempts were made to increase the density and size of the precipitated particles so that they would settle out more quickly and easily.

In Fig. 1, Sketch 1 shows an early European design of a continuous treating unit. In the United States, early installations employed mainly for softening made use of the Kennicott design (Sketches 2 and 4). In neither of these designs (Sketches 1 and 2) was any attempt made to employ the already-formed precipitated solids to aid in hastening the chemical reactions, or in forming more settleable precipitates.

Seeding in Chemical Reactions

Along about the turn of the century, chemists were able to show commercial applications of the principle of contacting reagents and solutions with already-formed precipitates in speeding up chemical processes. The advantages found for this practice applied mainly to reactions taking place at colder temperatures.

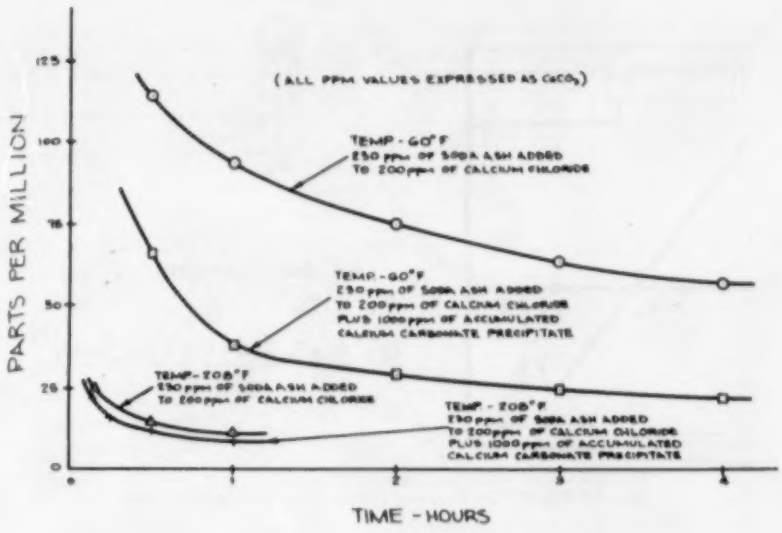


Fig. 2—EFFECT of temperature and contact time on speed of reaction

Water treatment chemists found similar benefits to result by using this principle in water treatment reactions. It was found, for example, that the addition of already-formed solid precipitates presented such a tremendous surface area in the mixture of water and chemicals that the newly-formed precipitates formed more quickly, with less excess of chemical reagent. In addition, the precipitates formed on the surfaces of the already-formed particles result in heavier, more easily settleable particles. The effect of seeding is shown in Fig. 2 (Ref 1), where rate of softening is appreciably affected by contact with accumulated precipitates or "seed" as well as temperature.[1]

As far as is known, the first commercial application of this principle in water treatment was the Duclerc unit (1st design) shown in Sketch 3 (Fig. 1), about 1900. In this unit incoming water and chemicals were contacted with a bed of heavy solid precipitates; then the unit allowed to settle out any particles of turbidity not removed by precipitation. This unit was subject to some channeling of water and chemicals and also to improper mixing, so that the Duclerc unit (2nd design) Sketches 5 and 6 (Fig. 2) were developed to provide

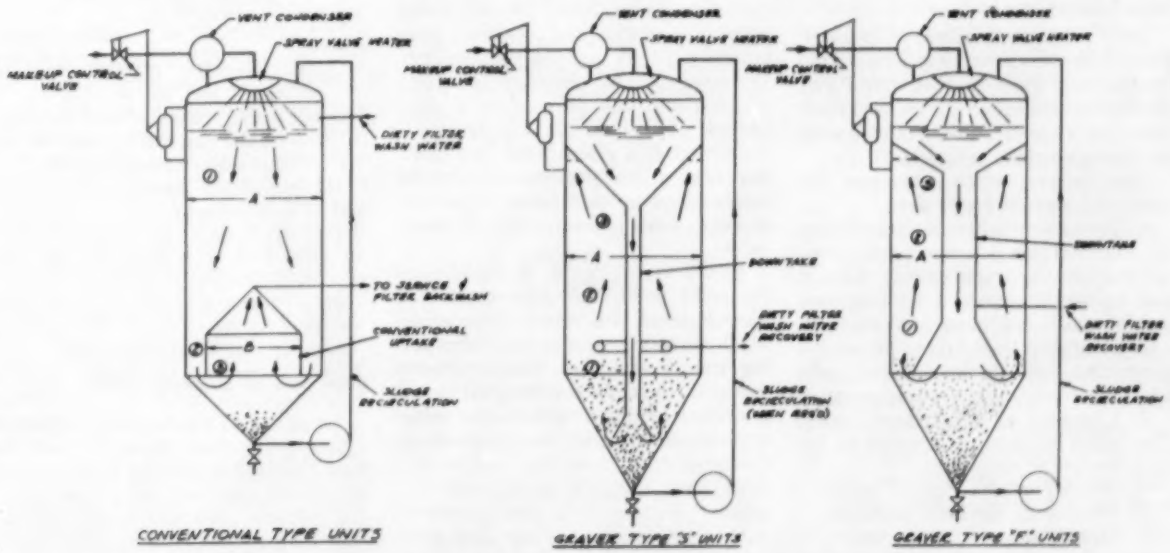


Fig. 3—DESIGN variations of hot process softeners. Principle of contact sludge bed used in Graver units.

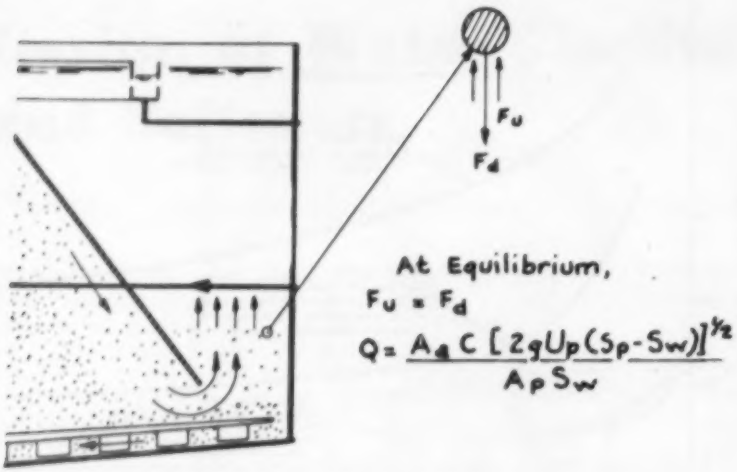


Fig. 4—RELATION between particle size and settling area

air or mechanical agitation of water, chemicals and already-formed precipitated solids.

The early units installed were operated mainly for cold process lime or lime-soda softening applications, where very heavy and settleable precipitates of calcium carbonate and magnesium hydroxide are formed. Later, these same units were applied to clarification of highly turbid or colored water, where coagulants such as alum and iron salts are employed and where in many instances the precipitates formed are lighter and not as easily settled as the calcium and magnesium salts.

Fig. 3 illustrates three variations of design of hot process softeners, two of which make use of the principle of contact with a deep dense sludge bed.

Separating Precipitated Solids From Treated Water

Once solid precipitates are properly formed in the chemical reactions, the treating unit must be so designed that maximum separation of all the solids from the treated liquid (both coarse and fine particles) is effected.

The factors which influence the clarity of treated water are:

1. Upward velocity of treated water in the region where separation of solids from the water occurs. This is also called the upward settling rate and is usually expressed in gpm/sq.ft.
2. Height of liquid from the sludge separation zone to the collector, and retention time in the separation zone.
3. Viscosity of the treated water. This value is mainly a function of the temperature of the water.
4. Density of the treated water.
5. Density of the solid particles.
6. Size of the solid particles.

In a quiescent medium, the settling velocity of a solid particle in water may be calculated from Stoke's Law as follows:

$V = [73.9 \times D^2 \times (S. - S_2)] \div Z$

where:

V = velocity of fall in feet per second
D = diameter in inches of particle
$S.$ = density of particle in pounds per cubic foot
S_2 = density of fluid in pounds per cubic foot
Z = viscosity in centipoises

However, in units of the present day general design, the solid particles must be settled out downwardly from the treated water which has an upward velocity and upward force component. In order to clearly understand the importance of designing the cold process softener, clarifier or hot process softener for maximum settling zone area, for greatest depth of water between sludge separation zone and collection point, and for obtaining maximum water and reaction temperature, let us analyze the problem. We must establish the various factors which come into play when a solid particle of a given size and density is supported at a given plane in a clarifier, cold or hot process softener, by virtue of an upward force created by upward water velocity and displacement.

As shown in Fig. 4, at equilibrium the solid particle is stationary at a given upward flow rate and therefore, the downward and upward forces acting upon it are equal. The downward force is equal to the weight of the particle less the weight of the water it displaces and can be expressed as follows:

(1) $F_D = V_p (S_p - S_w)$

where:

V_p = the volume of the particle
S_p = the density of the particle
S_w = the density of the water

The upward force is equal to the difference in fluid pressures between the upper and lower side of the particle multiplied by the cross sectional area on which the pressures are exerted, as follows:

(2) $F_U = (P_D - P_U) A_p$

where:

P_D = fluid pressure on lower side of particle (in weight units)
P_U = fluid pressure on upper side of particle (in weight units)
A_p = cross sectional area of particle

At equilibrium, when the solid particle is stationary, these two forces are equal:

(3) $F_D = F_U$

(4) $U_p(S_p - S_w) = (P_D - P_U)A_p$

Converting to difference in head of water flowing, we obtain:

(5) $h = P_D - P_U/S_w = U_p (S_p - S_w)/A_p S_w$

Equation (5) represents the net pressure drop across the particle and, neglecting friction, is seen to depend only on the particle dimensions and the densities of particle and fluid.

For flow of water or other fluid past the aperture surrounding a solid particle, in a medium of solid particles suspended at a given plane in water, we can say that:

(6) $V = C\ (2gh)^{½}$

where:

V = velocity of water, feet per second
g = acceleration of gravity
h = head of water in feet
C = coefficient of flow friction depending mainly upon viscosity of the water and smoothness and area of the surface of the solid particles. The greater the viscosity, the lower is C.

(7) $V = Q/A_a$

where:

Q = volumetric rate of flow in cubic feet per second.
A_a = average area around the edge of the particle through which the water flows upwardly.

By combining equations (5), (6) and (7), we obtain:

(8) $Q/A_a = V = C\ (2gh)^{½} = [2\,gU_p\,(S_p - S_w)^{½}/A_p\,S_w$

(9) $Q = A_a C[2gU_p(S_p - 2_w)]^{½}/A_p\,S_w$

Flow Rate to Suspend Solids

Equation (9) is the basic equation defining the relationship between the flow that will suspend a solid particle at a given plane and the properties of the particle and the water flowing past the particle. This equation clearly shows the following:

(a) The bigger the aperture, or

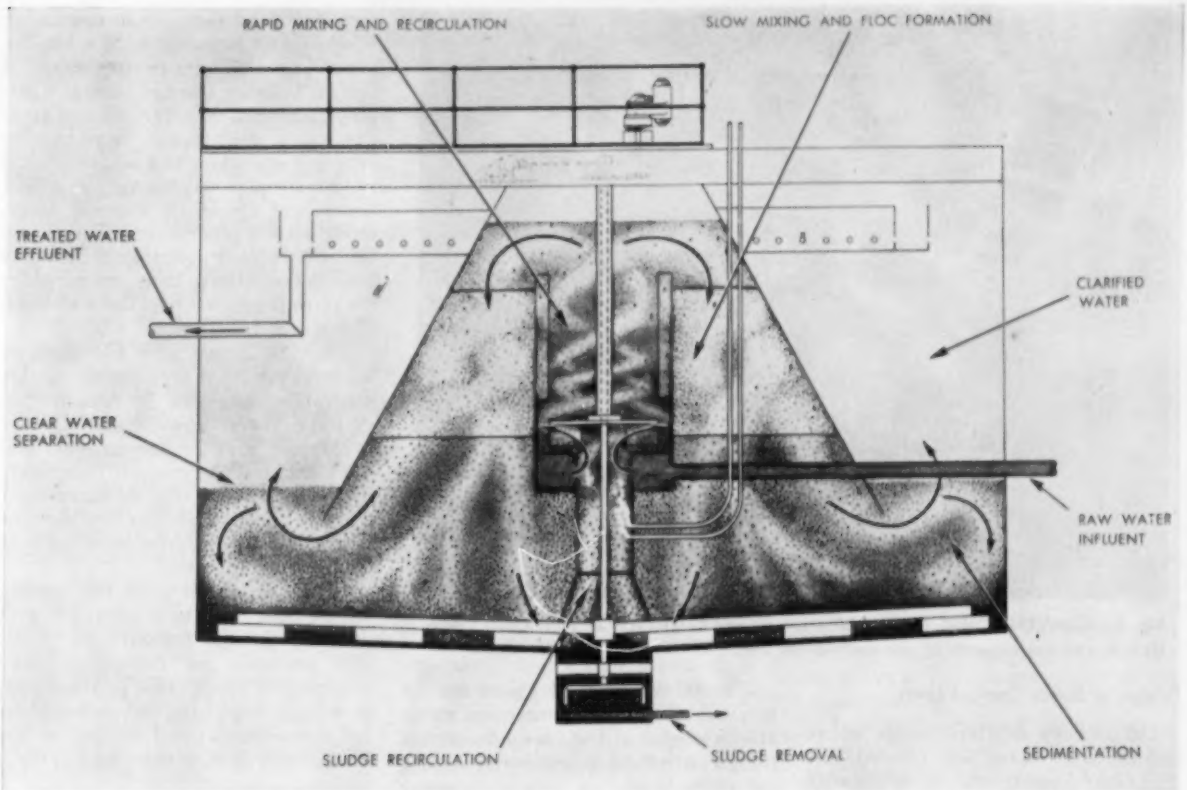


Fig. 5—FLOW PATTERN of Graver Reactivator is illustrated in this sectional view of a cold process softener and clarifier

area of water flow surrounding the solid particle, the greater the flow which can be pushed past the particle and suspend it motionless without carrying it up and over as turbidity into the collector. This provides the theoretical basis for applying the principle of maintaining the very greatest area in the settling (or separation) zone, so that all of the solid particles are separated from the treated water. This is usually 1.5 to 2.0 gpm/sqft for clarification, and 1.5 to 2.50 gpm/sqft for softening.

(b) Since all types of upward flow units have relatively large concentrations of solids of different sizes in a given space, the presence of a great height of fluid in a column through which the fluid must flow results in each particle finding its own plane of separation where the aperture area is large enough to just suspend the particle by difference in water pressure loss around the particle. In effect, then, a cylindrical column in which these solid particles are suspended is one in which there is an increase in average flow area between the solid particles at planes in the lower regions (where the heavier, coarser particles are found) and the lighter particles (in planes at a higher level in the column). This formula merely provides the theoretical confirmation of the practical application in clarifier, cold and hot process design, of a high column of clear water above the optimum solids-from-liquid separation point and up to the effluent collector. Consequently, the design of a clarifier or softener must provide maximum depth or height of water between the sludge separation area and the collection point.

(c) C, the coefficient of flow friction, is a function of viscosity of the water, smoothness and area of the surface of the solid particles.

$$C = K/Z\pi\ D_p^2$$

where: D_p = diameter of particle assuming spherical shape
Z = viscosity of the water
K = smoothness coefficient of particle

This is the theoretical basis of the practical engineering principle, frequently applied in the field, that the lower the water viscosity (i.e., the higher the water temperature) the greater is C, and the more flow can be pushed past the particle to maintain it suspended at a given plane. The peripheral area over which the water flows and the smoothness coefficient of the surface of the particle also come into the picture.

(d) The greater the difference in density between the particle and the water (i.e., $S_p - S_w$) the greater is the upward water flow which can be permitted to suspend the particle at a plane. This is a square root function. Precipitates of $CaCO_3$ and $Mg(OH)_2$ generally are heavier than most floc-turbidity combinations found in simple clarification problems. This has resulted in the development of coagulants and coagulant aids which, together with optimum pH coagulation conditions, produce floc mixtures of maximum density in simple coagulation.

(e) The greater the average diameter and volume of the solid particle, for a given particle density, the greater the downward force component (square root function). The reason for this is that the volume of a particle varies as the cube of the diameter, whereas the surface area of the particle, which is related to the upward frictional force, increases as the square of the diameter. This is the theoretical basis for the practical design of hot process units or Reactivators, where every attempt is made to increase solid particle size and thus improve settling. (For example, for spheres, volume $= 4/3\ \pi\ r^3$, sphere area $= \pi\ d^2$).

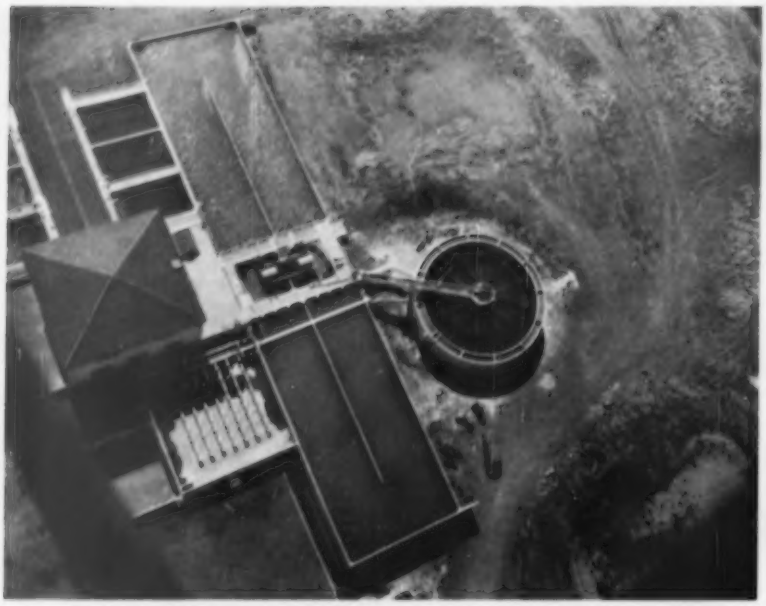


Fig. 6—CONVENTIONAL rectangular clarifiers and Reactivator at West Coast Utility. Upflow unit has capacity of one rectangular unit.

Design of Solids Contact Units

Particularly in clarification where lighter precipitates are formed, the effect of proper contact of solids with water and chemicals is especially apparent. Today, the application of the principle of intimate contact of large volumes of solids with raw water and chemicals to accelerate chemical reactions and settling of solids is an accepted fact by all manufacturers of water treatment equipment.

The points of difference between various cold process unit designs revolve mainly about:

(a) The concentration of solids, and therefore the surface area, brought in contact with the intimate mixture of raw water and chemicals as indicated in Figure 2.

(b) The flexibility in control as well as time of contact between solids, raw water and chemicals.

(c) The internal design of the clarifying unit, providing for the separation of solids from treated water at the highest possible settling rate.

(d) The internal design of clarifier, providing for maximum height or depth of water between the sludge separation point and the clear water collector.

(e) The arrangement provided for accumulating the solid precipitates and removing them easily and continuously.

(f) Provision for optimum multiple clear water collection area to preserve uniform cross sectional upward flow lines.

The fundamental design of one of the several types of units now available is shown in Fig. 5. Units of this design have been in successful service for many years.

The well-established principles of physical chemistry and hydraulics which are employed in this design are:

(1) Intimate prolonged *and controlled* contact of treating chemicals and raw water with previously formed precipitates or solids in order to complete the chemical reactions more rapidly, and to form larger and heavier, more easily settled solid particles. This is accomplished by employing a rapidly-rotating, mechanical agitator to recirculate 1 per cent to 5 per cent sludge (by weight) slurries, at rates of 2 to 5 times the output rate, in and around the uptake and flocculating zones in the center of the unit. Contact with solid particles in the sludge is equivalent to many more times the contact provided in ordinary so-called upflow "sludge blanket" units. Variably-controlled sludge recirculation provides maximum flexibility in adapting operation to load conditions.

(2) Proper flocculation of solids, water and chemicals forming large, easily settled precipitates. This is obtained by proper agitation in the outer conical flocculating zone, produced by the central agitator-impeller with variable speed drive.

(3) The largest area and depth of water is provided between the sludge separation zone and the collector, so that the lowest upward settling rate is obtained, and the fine turbidity and solid material is removed completely without the possibility of carry-over. This can occur in clarifier designs where the sludge separation zone is close to the collector.

(4) The largest area for settling out of heavy solids is provided with virtually the full bottom area of the unit available for collecting heavy precipitated solids. This is in contrast to designs employing elevated pockets for concentration and relying on hydraulic flow to raise the solids to these pockets.

(5) A positive and continuous mechanical movement of settled solids to a central concentrating pit and then to waste, is provided by means of a separately-driven sludge scraper arm, rotating at slow speed.

The bed of sludge in the settling zone of this solids contact unit is maintained very low (at least 8 to 10 feet below the outlet collector trough) by proper automatic blowoff and sludge scraper operation. This provides a suitably large depth of clear water above the bed for settling out the remaining traces of turbidity in the treated water, and avoids any possibility of "shocking" particles of turbidity out into the effluent due to rapid changes in flow. This design contrasts with others in which the top of the sludge bed or "blanket" is maintained only 3 to 5 feet below the effluent collector trough, and in which turbidity can easily be carried over into the treated effluent.

Solids contact units of this type are designed for upward settling rates of 1.25 to 2.0 gpm per sqft for clarification, and 1.5 to 2.5 gpm/sqft for cold process softening, with a minimum retention time of 60 minutes (as compared to 3 to 4 hours retention in the conventional type of units).

TABLE I

Water Analyses Variation
West Coast Utility Plant

	Raw Water	Treated Water
PH value		
Minimum	7.8	7.3
Average	7.5	6.8
Maximum	6.9	6.4
Turbidity, ppm		
Minimum	30	2
Average	50	4
Maximum	400	8

Flow Rate: 3 MGD
Dosages: Chlorine—2.0 ppm
Alum—1.75 gpg

Operating Results Reported

In hundreds of installations in municipalities and industrial plants, un-

der widely varying loads, water composition, and operating conditions, the type of unit illustrated in Fig. 6 has demonstrated its ability to produce uniform results as guaranteed—regardless of variations in flow, load, and generally of other wide variations in water composition.

In a West Coast water utility installation, Fig. 6, two large solids contact units of this type have been in service for more than 8 years. These operate in parallel with conventional 4-hour retention units producing water of comparable quality (i.e., less than 5 ppm turbidity), at equivalent chemical dosages. Surges in flow, up to 30 per cent of rated capacity within a few minutes, are readily absorbed by the solids contact units. Furthermore, on starting after weekend shutdown, low turbidity treated water is obtained more quickly with the modern solids contact units than with the conventional units. This is primarily due to the ability of the modern units to keep accumulated sludge in an active condition by means of the sludge scraper—which continues to operate during shutdowns. Table 1 shows raw and treated water analysis for this installation. Fig. 7 shows another installation of this type of solids contact unit in an eastern municipality, treating river water at a rate of 1056 gpm.

Surges in Unit Loading

The ability of a sludge-contact clarifier or cold-process softener to take surges in load, i.e., surgeability, is a good indication of its stability under varying operating conditions.

An important factor in ability to withstand surge is the inherent design of the clarifier proper. Important design factors are: rate selection, as related to the specific operating conditions of raw water temperatures and composition, climate, location of equipment, chemical operating costs, degree of operating attention, etc. The features of controlled sludge recirculation, and intimate sludge contact in a sheltered inner cone, followed by passage of sludge and treated water through a shallow sludge separation zone permit the type of solids contact unit illustrated in Fig. 5 to have a high surgeability factor; i.e., yield uniform results even under appreciably and rapidly varying loads.

In a recent test at an eastern paper mill installation, a 4200-gpm rate Reactivator was surged from a 2600- to a 4200-gpm rate in a period of less than 6 minutes. Fig. 8 shows a plot of the pertinent data taken from log sheets at this plant.

Fig. 7—MUNICIPAL 1056 gpm Reactivator in western New York State

Design Rates vs. Operating Rates

It should be borne in mind, however, that there are many applications where upward flow conventional equipment of the type shown in Fig. 9, illustrating the Graver RotoRake, or rectangular horizontal flow equipment, is applicable. The matter of design rate selection is an important consideration in each type of equipment.

Consulting and staff engineers have done a remarkable job of designing water treatment installations for municipalities and industry—installations that produce results dependably and economically. One of the reasons for this has been the availability to consulting and staff engineers of equipment and data from the various equipment suppliers, based on proper consideration for the various factors influencing operation. Factors such as temperature, raw water composition, flow rates (including peak, average and minimum flows), operating attention available, etc., have been studied to arrive at suitable equipment design capacities.

In water treatment equipment design, as in all well-engineered units, it is important to distinguish between the design capacity and the peak or maximum rate capability of the equipment. Manufacturers of automobiles build cars of 200 and 250 hp, for 125 to 175 mph speeds—and utilize this power in performance tests (at somewhat higher fuel costs)—but the average car is used for only a fraction of this speed and horsepower most of the time. Similarly, in water treatment equipment design equipment is usually capable of far more than design capacity, as the consult-

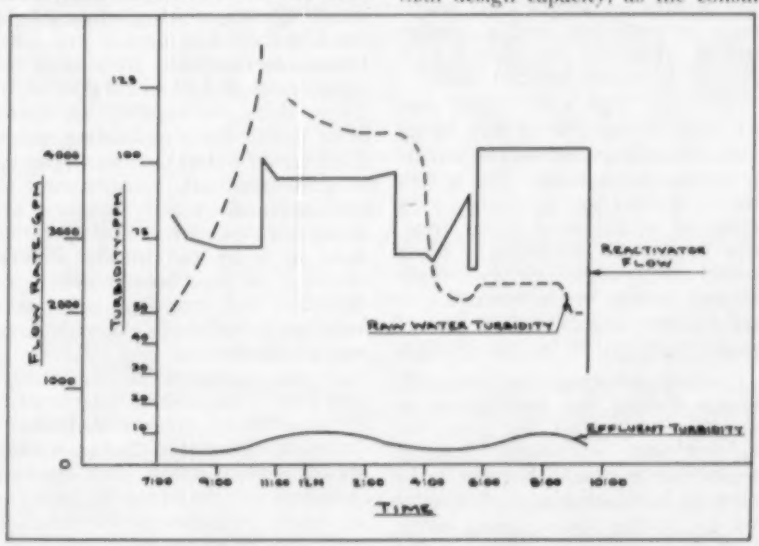


Fig. 8—GRAPH illustrating relation between raw water turbidity and effluent turbidity in Reactivator at eastern paper mill

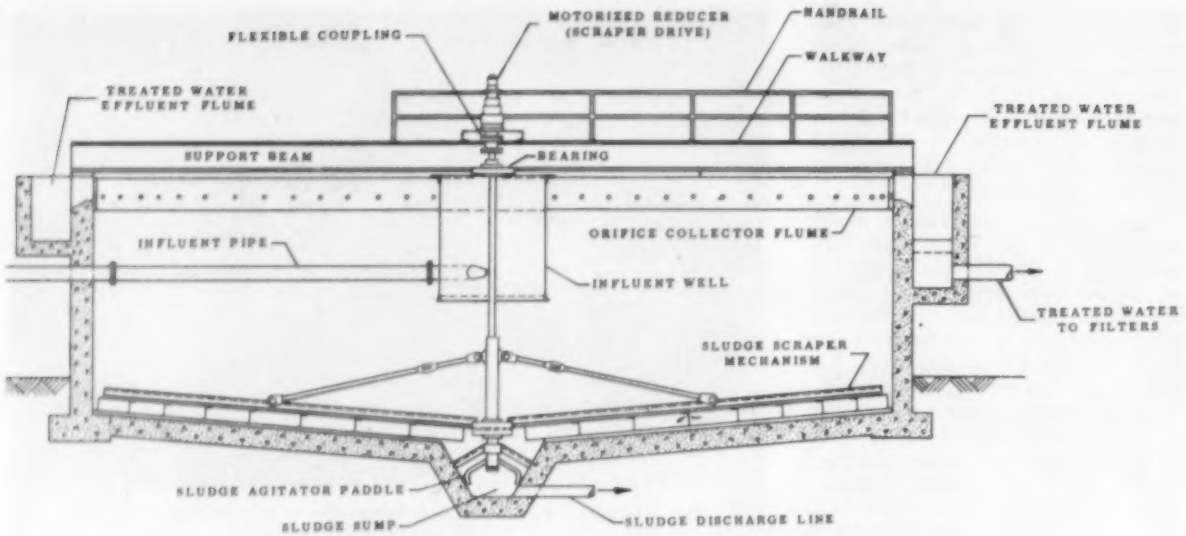


Fig. 9—CROSS SECTION plan of the Graver Roto-Rake sedimentation basin

ing engineer specifies flexibility in operation and dependability for the specific operating conditions to be encountered.

For example, the well-known simple sodium zeolite softener can be operated for short periods of time with a clear hard water supply at flow rates as high as 8 to 12 gpm/sqft. However, the standards employed by most engineers for selection of *design capacities* of sodium zeolite softening units are 4 to 6 gpm/sqft.

With clarifiers and cold-process softeners, also, it is important to distinguish between design capacity and performance capability. In most municipal and industrial applications of such water treatment equipment, the difference in installed cost between a plant practicably designed and realistically proportioned, and a smaller plant is frequently less than 3 to 5 per cent on an installed cost basis.

The term "high rate" solids contact units, as applied to this equipment, is a relative one and is worthy of discussion. Actually, the upflow rate and settling area established for a municipal or industrial water treatment installation employing a solids contact unit is dependent upon study of many factors by the consulting or staff engineer as indicated above, and should be defined in his specification.

Practical operating experience with various designs and installations on many water supplies has given the engineer and equipment designer ample data to establish rules to be followed in establishing upflow rates and in settling areas specifications. With this in mind, it is obvious that design rates of solids contact units will vary with the specific plant conditions as well as results to be obtained. Where experience and good engineering practice so indicate, a safe "high rate" should be employed, i.e., a rate as high as is practicable to achieve the goals of the plant design engineer of dependable, low cost operation with minimum operating attention.

Solids contact units for clarification and cold-process softening should be selected and installed with careful consideration of all the operating factors involved. For cold-process softening, design rates of 1.5 to 2.5 gpm/sqft are recommended; with capabilities, in many cases (particularly on warm, higher hardness water supplies) of flow rates up to 2.7 gpm/sqft. For clarification of fairly clear water supplies, which produce a light floc with the use of alum or iron salts, Reactivators normally are selected for design rates of 1.25 to 2.0 gpm/sq.ft. These units are capable, in many cases (particularly in treating warm, more turbid waters), of flow rates up to 2.50 gpm/sq.ft. Furthermore, all such applications and selections are made with lowest chemical operating costs in mind and usually without counting on the "booster effect" of densifiers and coagulant aids (activated silica, cellulosic materials, clay, super-chlorination and others) to high rate operation. In cases where well-known coagulation interferences (organic matter, syndets or other pollutants are present in the raw water), special coagulation and chemical treatment technique must be developed to assure optimum performance of equipment at all times.

Good engineering practice demands full consideration of the factors entering into dependable and low cost operation of all equipment for the specific conditions encountered. Careful selection of equipment for the clarification and cold-process softening of water supplies requires fully as much good engineering as any other item of equipment available to the design engineer.

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W&SW

A "Ship-Shape" Sewer!

According to a Florida newspaper, a civilian pilot reported seeing a 200-foot ship capsized in the Atlantic off Fernandina Beach. Oil was gushing out, he said.

A Coast Guard cutter and two planes rushed to the scene. The "ship" turned out to be a sewer outfall protruding into the ocean. The "oil" was sewage pouring out.

New Editor Joins Staff

Considerable pleasure and pride are taken in announcing that on May 1st Herbert P. Orland joined the staff of *Water and Sewage Works* as Associate Editor. He also will be Associate Editor of the companion magazine *Industrial Wastes*.

To most of our readers, Mr. Orland needs no introduction, since he has been associated with publications in the water and wastes treatment fields for a number of years and has been a consistent author of articles on both subjects.

Mr. Orland's education and experience especially fit him for his new assignment. With experience in heavy construction, municipal engineering, and municipal management, as well as long experience with technical publications, he has become well-known to industrial and municipal personel in both the water and wastes treatment fields.

After early schooling in the New York City system he attended Cornell University, from which he graduated with the degree of Civil Engineer in 1935.

Following graduation he was engaged as a steel designer and estimator and then served an apprenticeship under a city manager preparatory to entering that field. There followed several years of special duty assignments with the Corp of Engineers, U. S. Army, as office engineer and resident engineer on construction of flood control dams, flood walls, military air fields, coastal defenses, ammunition storage depots, and cantonments.

Mr. Orland then became Municipal Manager of Northfield, Vermont. In this position he figured prominently in long-range planning for both waterworks improvements and sewage treatment facilities. During this period he also served as Instructor and then Assistant Professor of Civil Engineering at Norwich University, as well as consultant to several Vermont and New Hampshire towns and industries on water supply and wastes treatment problems.

He then became Assistant Editor of *Engineering News-Record*, where his primary assignment was in the sanitation and municipal fields. It was during this period that he acquired his wide acquaintanceship throughout the United States and Canada with public health, municipal, industrial, and consulting engineering staffs, as well as his extensive knowledge of the water and sewage treatment facilities of both countries.

There followed two years as Associate Editor of Technical Publications for the American Society of Civil Engineers. Besides editing the Society's *Proceedings* and *Transactions*, he also edited several manuals and special publications. During the same period he was a Special Lecturer in Sanitary Engineering at The Cooper Union.

He left ASCE to become City Engineer of Long Beach, New York, where he was instrumental in consummating plans involving expenditures of several million dollars for new sewerage and sewage treatment facilities; new water supply, treatment and distribution facilities; and a new refuse incinerator.

Readers in the sanitary engineering field will recognize Mr. Orland best, perhaps, for his work since 1949 as Associate Editor of *Sewage and Industrial Wastes*, the journal of the Federation of Sewage and Industrial Wastes Associations. Besides spearheading major improvements in the format and style of that publication, he also developed a widespread following among operators, engineers, and others, with his handling of the special section entitled "The Operators' Corner" and his participation as a speaker at many water, sewage, and industrial waste meetings and schools.

He is the author of several papers in technical journals of the United States and Canada and has been active on committees of the several professional and technical societies of which he is a member. His society memberships include the American Water Works Association, the Central States Sewage and Industrial Wastes Association, the American Society of Civil Engineers, the American Public Health Association, the Illinois Society of Professional Engineers, the National Society of Professional Engineers, and the Air Pollution Control Association. He is also a Licensed Professional Engineer in New York State and a Registered Engineer in Illinois.

A Full Cycle in Chlorinator Design

Simplicity and economy of construction have been made possible by the availability of modern corrosion-resistant materials

by WALTER L. SAVELL

Mr. Savell, Consulting Engineer, Westport, Conn., has had many years of technical experience with producers of liquid chlorine. His background for this article derives from services as technical advisor to Fischer and Porter Co., manufacturers of chlorinators.

A SATISFACTORY water chlorinating operation, in common with all continuous processes, depends upon two conditions: measurement and control.

As might be expected, the first attempts to apply gaseous chlorine simply used a pipe line leading from a cylinder of chlorine directly into the water to be treated. A short experience with this equipment was sufficient to convince any engineer or operator of the faults and inefficiency of such a simple system. Because of its relatively low solubility and low rate of solution, most of the chlorine so applied merely bubbles through the water to the surface.

A limited measure of success has been achieved in applying chlorine gas directly, by connecting a porous diffuser to the delivery pipe at the point of application. However, problems associated with the use of this device relegate the method to a position of a poor second choice. The limited range of application rates and the variation in pressure drop across the porous medium (because of the tendency of the pores to become obstructed by vagrant solids) are two of the more obvious faults of this method.

An immediately evident shortcoming of the simple system of chlorine cylinder and pipe line delivery is the impossibility of regulating gas flow with even a moderate degree of accuracy by using the control valve on the chlorine cylinder.

Complicating the problem further is the fact that not only is the gas under pressure, but the pressure varies in the cylinder with changes in the temperature of the air surrounding it. In a closed cylinder the pressure varies from 59 pounds per square inch at 50°F to 144 pounds per square inch at 100°F (Fig. 1). Also, the temperature of the cylinder and of its contents changes as a result of the cooling effect of liquid evaporating to gas; when gas is withdrawn, the rate of cooling increases as the rate of evaporation increases. The changes in gas pressure result in corresponding changes in gas flow at any specific setting of the cylinder valve.

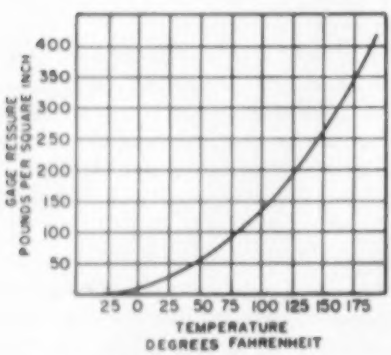


Fig. 1—PRESSURE—TEMPERATURE relation for chlorine gas

Early Chlorination

At the time liquid chlorine first became available in cylinders, the spring loaded pressure reducing valve was well established in the technology of gas handling. It was natural to consider this device in designing apparatus for chlorine control. Also the dissolving of chlorine in water, to make solutions of satisfactory concentration for applying in treatment, was sufficiently well understood to present no serious mechanical problems in apparatus design.

To fulfill the needed conditions of measurement and control, three elements in apparatus and process design appeared early in the history of chlorinator development; and have persisted throughout the history of water chlorination technology:

1. The rotameter as a flow rate measuring instrument for chlorine gas.
2. The spring loaded diaphragm valve for controlling the pressure (and therefore the flow) of both chlorine and water.
3. A water solution of chlorine, prepared in the apparatus, to mix with the water to be treated.

In other words, the basic mechanical elements of apparatus required to provide a practical chlorinator were at hand when chlorine first appeared on the industrial scene. A chlorinator is a suitable combination of spring loaded diaphragm pressure control valves, pressure gauges, flow indicators, safety devices for protection of operator and apparatus, and a device for preparing and delivering a solution of chlorine in water. Such a combination, furnished with a supply of chlorine gas at a constant pressure and at a reasonably uniform temperature, will dependably deliver a solution of chlorine at a specific concentration. All these items in suitable mechanical form already had been invented and proved reliable for service with water, steam, compressed air, and other fluids. Simple as a chlorinator is in principle, good mechanical design is not enough. Limited experience in continuous processing, and other special conditions associated with the properties of chlorine, created a number of difficulties.

Although the early production of liquid chlorine was quite pure by

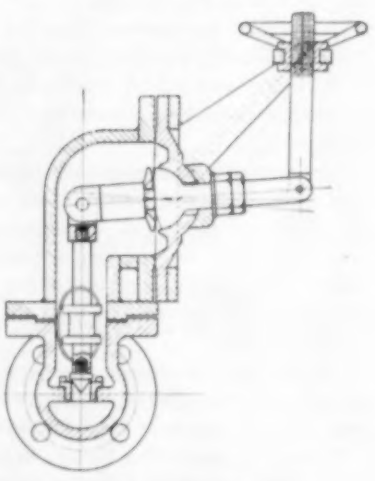
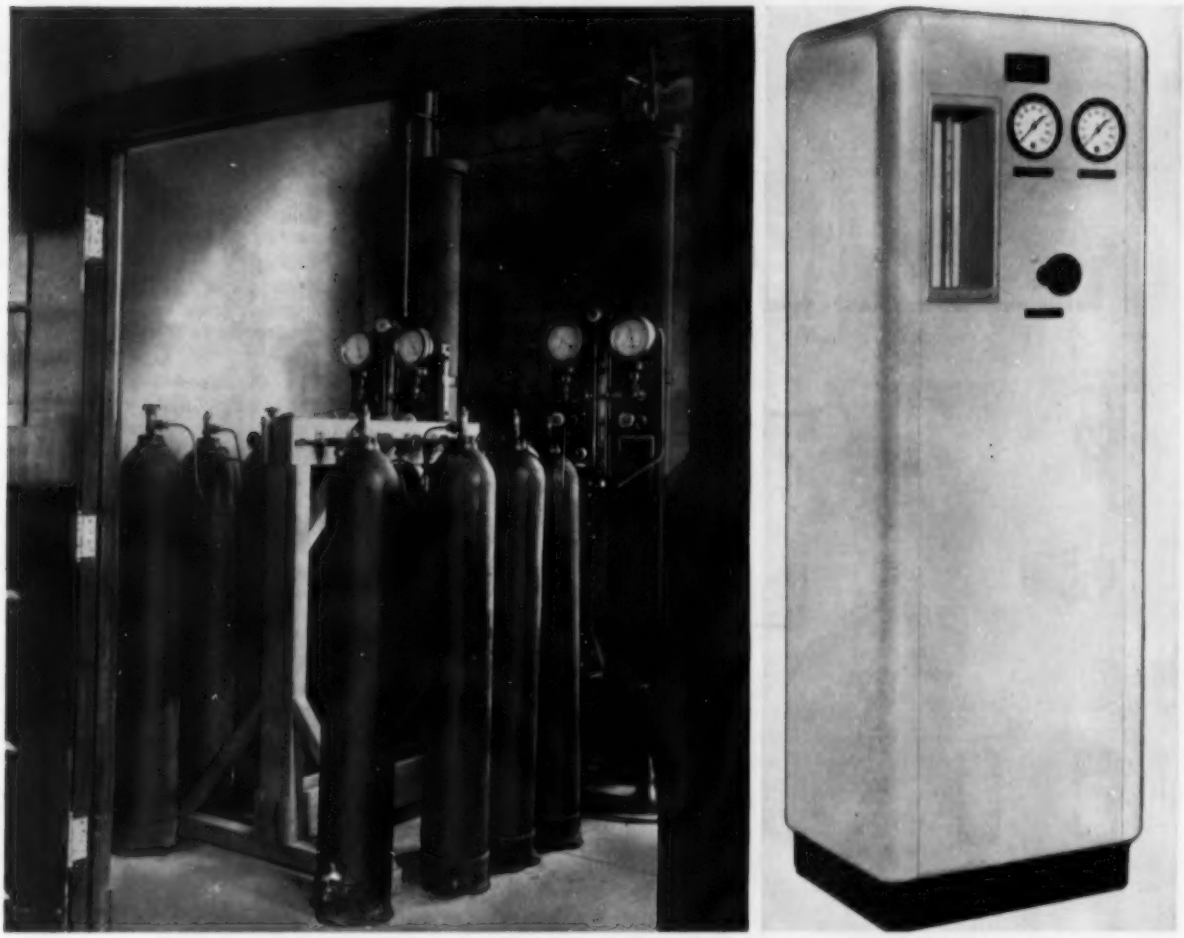


Fig. 2—CHLORINE control valve (1939) diaphragm-sealed type



PROGRESS in 40 years. Rotameter chlorinators at St. Louis water plant, 1915, and a modern chlorinator.

chemical standards of that time, small amounts of organic impurities were present. These impurities were derived largely from reaction of the chlorine with the carbon anodes in the electrolytic cell in which the chlorine was produced.

Unique Chlorine Characteristics

Therefore, added to the normal mechanical problems the engineer has in designing a chlorinator, there are a number of special problems that must be considered. Specific problems are:

(a) Chlorine, a liquefied gas under pressure, vaporizes as the valve is opened and the gas pressure is released. Thus, the temperature of the expanding gas and of the liquid chlorine remaining in the cylinder is lowered. At high rates of use the loss of heat by evaporation of liquid may be sufficient to cause the temperature of the cylinder and its contents to drop below the freezing point of water. Moisture in the atmosphere will condense on the surface of the cold cylinder and in time will form a coating of frost. The cold gas coming in contact with cold water may form "chlorine ice" (chlorine hydrate).

(b) As the Temperature vs. Vapor-pressure Chart (Fig. 1) shows, the vapor pressure of chlorine increases with rising temperature. Cylinders containing chlorine must be stored and handled so as to avoid exposure to temperatures much above atmospheric. (A chlorine cylinder may discharge its contents by release of the fusible safety plug as the result of exposure to abnormally high temperature.)

(c) Just as increasing pressure at a given temperature will cause chlorine to condense, a decrease in temperature will do the same thing. A small drop in temperature at a point between the vaporizing liquid and the point of delivery frequently will cause a recondensation of the gas to the liquid form at the cool point in the pipe line or apparatus. Such a condition creates difficulties. Not only is the delivery of gas irregular with occasional "slugs" of liquid, but frequently there is a collection of organic impurities present at the point where the gas has condensed to liquid and re-evaporated. In a bell jar, as elsewhere, this condition is usually accompanied by the formation of "chlorine ice" which has been known to result in the interruption of service.

(d) Chlorine is a vigorous oxidizing agent. It forms compounds directly with a wide range of materials, both organic and inorganic. It is especially reactive at higher temperatures. At atmospheric temperatures it is safely stored in steel containers having values designed for chlorine service. At more elevated temperatures, even below a dull red, chlorine reacts vigorously with iron, brass and most other metals to form chlorides of the respective component metal elements. (An attempt by one user to increase the rate of chlorine evaporation by playing the flame of a blow torch on the side of a cylinder demonstrated the reactivity of chlorine. It

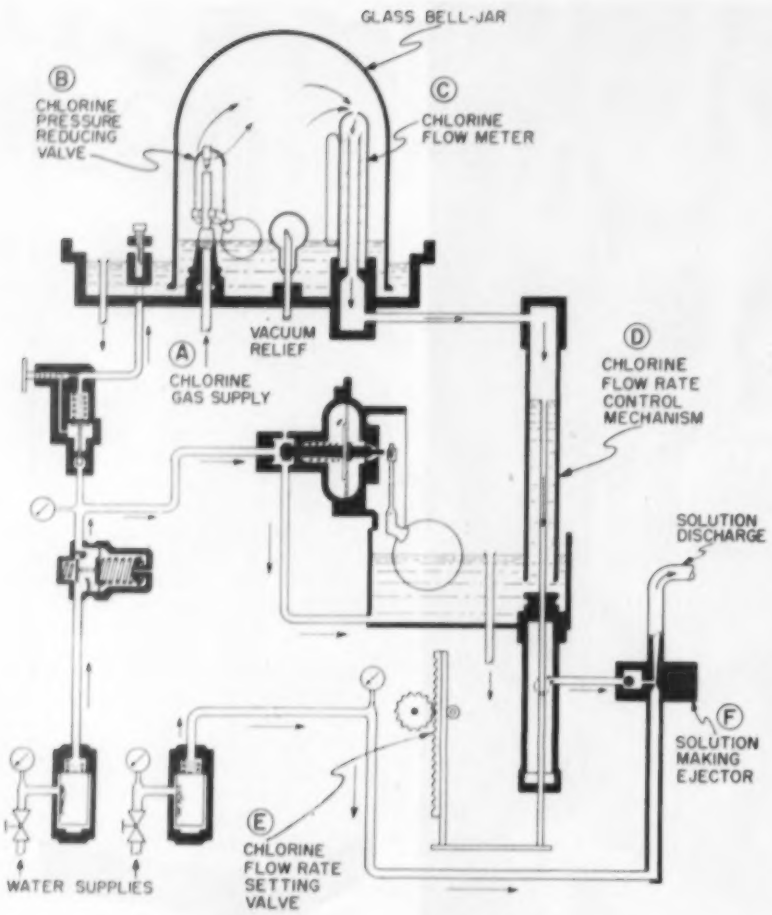


Fig. 3—SCHEMATIC diagram of "hydraulic type" chlorinator

resulted in the discharge of the cylinder contents through a hole created by the reaction of the chlorine with the heated iron at the point of flame contact.)

(e) The presence of water as liquid or vapor renders iron, brass and most other metals vulnerable to rapid oxidation by chlorine. This reaction is accompanied by the formation of hydrogen which under some conditions may create a hazard. (The writer inspected the results of an explosion of a chlorine cylinder brought about by this reaction. The cylinder had been allowed to stand overnight, discharging its contents as gas into a tank containing a water solution. The next day it was observed that there was no further discharge of chlorine and at the end of the working day the valve on the cylinder was closed. It was not realized that after the cylinder had discharged its contents, the solubility of the chlorine in the water solution caused the gas remaining in the cylinder to dissolve in the line which was still submerged in the water solution. The solution of the gas created a negative pressure and drew the water solution into the cylinder. After the valve was closed, the reaction of the water solution with the iron of the cylinder released sufficient hydrogen to create a pressure that burst the cylinder.)

(f) The strong, choking, acid odor of chlorine makes it very disagreeable to breathe. In low concentrations it seems to have no cumulative toxic effect and apparently is harmless to persons exposed to it. The disagreeable nature of the gas generally forces an individual to leave the affected area before dangerous concentrations develop. High concentrations of chlorine quickly become intolerable, and rapidly cause nausea. Limited exposure to high concentrations usually leaves no permanent after-effects. Exposure to high concentrations of chlorine over an extended period of time is lethal. The strong acid reaction of chlorine prevents oxygen absorption and creates destructive lesions in the lungs.

Handling and Control Problems

All these special problems illustrate the fact that the highly reactive nature of chlorine, making it so valuable as a disinfecting agent, is the property which has imposed the greatest problems for the engineer and designer of chlorinators. For many years the corrosive properties of chlorine, especially in the presence of moisture vapor, limited the application of the spring-loaded diaphragm valve to handling chlorine gas. Ingenious means have been devised to prevent contact of chlorine with the working parts of diaphragm valves. Such a one is illustrated in Fig. 2.

Early efforts to utilize the spring-loaded diaphragm valves in solution feed chlorinators were defeated by corrosion and because of gum formation. Units equipped with silver diaphragms were eventually developed and used successfully as pressure reducing valves on the dry side of the chlorine delivery line. However, it was necessary to insert other valves between the pressure reducing valve and the chlorinator to prevent reverse migration of moisture from any source. The body being of iron, the diaphragm valve could not function satisfactorily where it might be exposed to moisture or moisture vapor. These limitations deprived the engineer and operator of chlorinators of the most desirable and most generally used device for automatically controlling the flow of gases.

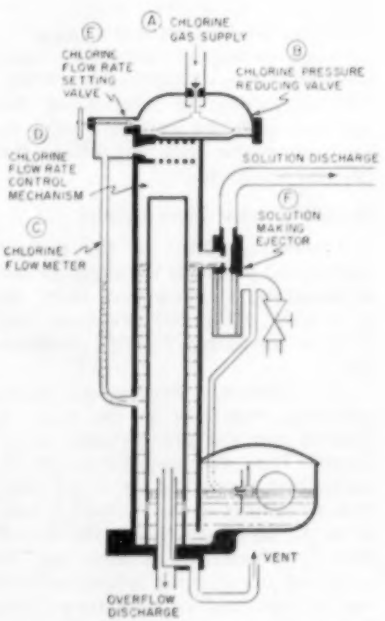


Fig. 4—CHLORINATOR no longer built has mechanical pressure-reducing valve

In spite of the special problems involved in its handling and control, the advantages offered by chlorine as compared with hypochlorite solutions made with bleaching powder (the first-used chlorinating agent) were outstanding and numerous. Also, the chlorine solution feed apparatus was definitely more acceptable than any device designed to treat a water supply with dry chlorine gas.

Design of Equipment

To meet conditions imposed by the reactive nature of chlorine, resort was made to an ingenious if somewhat fragile design of apparatus constructed in part of hard rubber and glass. Silver and platinum served for smaller parts because of good resistance of these metals to corrosion by chlorine-water solutions. Except for the pressure reducing valve on the dry gas line, the pressure control devices in the vast majority of chlorinators produced between 1917 and 1953 were of the "hydraulic" type (Fig. 3). The basic design was essentially unchanged and was characterized by inclusion of hydraulic devices for pressure and vacuum relief. Variable head orifice type meters serve as flow rate indicators.

These devices unquestionably have been satisfactory. They function and can be kept in operation for prolonged periods of time if given the required maintenance attention. However, the hydraulic chlorinators have two particular disadvantages:

a) The chlorine enters the apparatus in the presence of water and water vapor. As a result internal parts of the equipment are exposed to corrosive chlorine-water solutions.

b) The fixed orifice, variable head meter has an inherently non-linear scale. In the lower range the compression of the graduation intervals makes scale reading difficult and generally inaccurate; accuracy is attained over only the upper part of the scale. (Linearization of scales by use of tapered manometer legs is expensive and cumbersome.)

In the late twenties and early thirties chlorinators of different designs were offered by several manufacturers (see Fig. 4). Diaphragm valves of the spring loading type were used in the new units and the design seems to be reasonably satisfactory.

A manufacturer of swimming pool accessories in 1937 brought out a chlorinator (Fig. 5) which is still being marketed. A mechanical diaphragm-and-weight pressure regulator is used in this unit with a flowmeter of the variable area orifice type (the rotameter). This chlorinator retains a water tray and stand pipe as a part of the safety equipment, but it represents an improvement in design over other chlorinators insofar as the chlorine passes over a water surface but once. Since the contact is near the end of the system, the exposure of the equipment to wet chlorine is minimized.

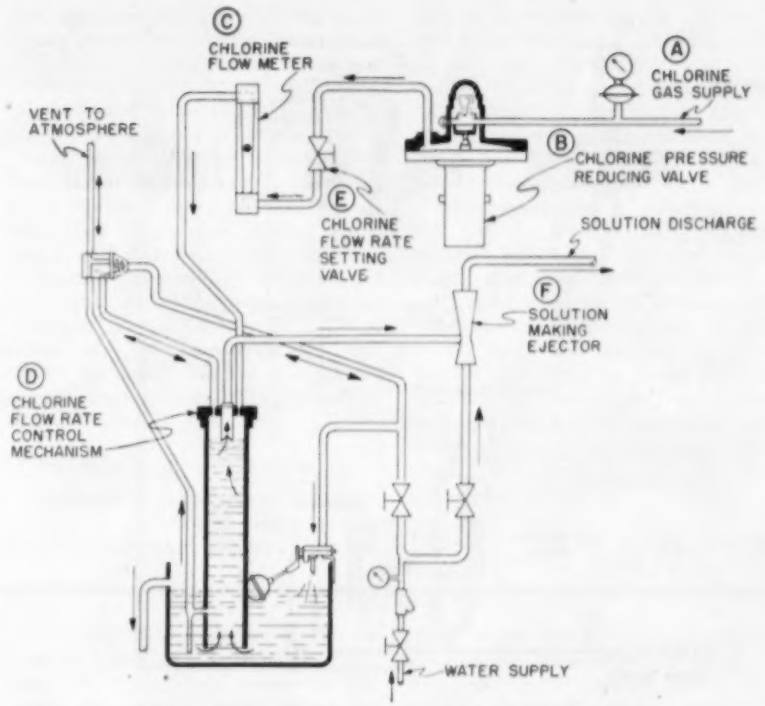


Fig. 5—SCHEMATIC diagram of chlorinator having mechanical means to control pressure reduction, flow metering, and flow rate setting

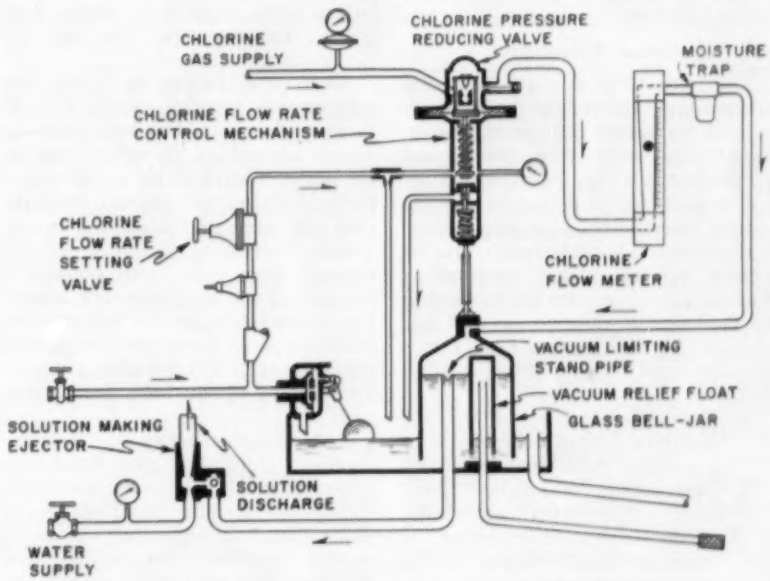


Fig. 6—SCHEMATIC diagram of a "hydraulic-mechanical" chlorinator

In 1948, a manufacturer of equipment for water and sewage treatment plants entered the chlorinator field. This unit (Fig. 6) has a mechanical diaphragm chlorine pressure-reducing valve (spring loaded), rotameter (variable-area type flow rate meter), and hydraulic safety devices. The familiar water tray and bell-jar ar-

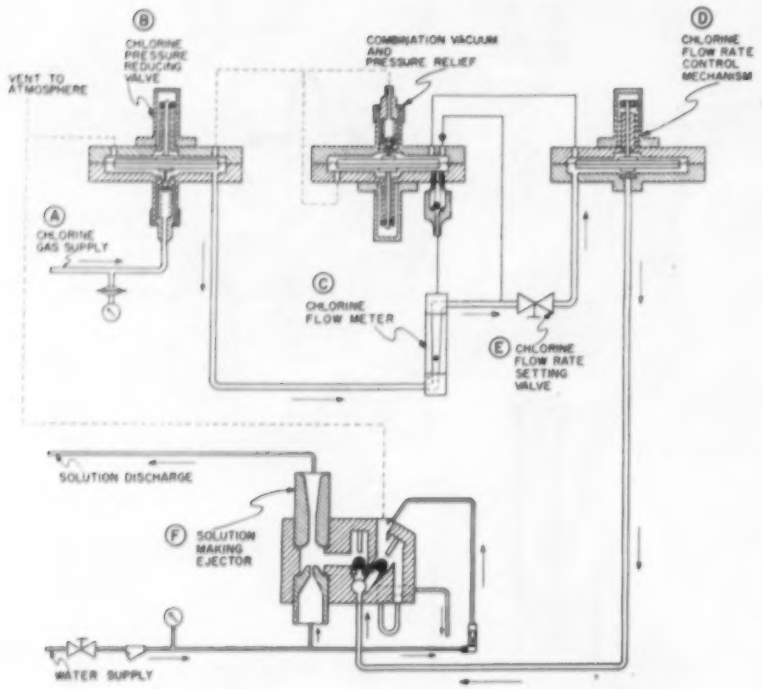


Fig. 7—SCHEMATIC diagram of a "full-mechanical" chlorinator

rangement functions primarily as a safety element.

Fully Mechanical Chlorinator

Not until 1949 was a commercial vacuum-type chlorinator built which utilized no water tray arrangement. Field tests were then started on a chlorinator (Fig. 7) designed by a manufacturer of industrial process control instruments and data reduction systems. This chlorinator may be termed "full-mechanical" inasmuch as it utilizes the rotameter for measuring the flow rate of chlorine gas and diaphragm-operated, spring-loaded mechanical regulators for *three* separate functions:

1. Reducing pressure of chlorine gas drawn from the cylinder to a constant value partial vacuum.
2. Maintaining a constant pressure differential across the needle valve used to control the flow rate of chlorine gas (with a rotameter as a flow indicator).
3. Controlling vacuum: by relieving chlorine to a vent line in case of vacuum failure, and by breaking vacuum in case of excess vacuum formation.

Simple in construction and use, the rotameter (Fig. 7) consists of an internally tapered glass tube, connected into the piping system in a vertical position. The fluid (in this case chlorine) to be measured passes through the tube from the bottom to the top. An indicator in the form of a free ball or other shape floats on the fluid stream and rises or falls with the change in rate of flow.

As a flow measuring device the rotameter is accurate over a 1 to 20 range of flow rate. The high accuracy, almost throughout the entire range of the scale, is attributable to the essentially uniform graduation intervals over the range of the scale. The uniformly increasing diameter of the tapered glass tube from bottom to top provides a variable orifice around the circumference of the ball or other indicator as it floats on the upward moving gas. The rotameter gives direct reading of flow rates and is easily read.

The manufacturer of the "full mechanical" chlorinator gave full recognition to the problem of corrosion. Being convinced of the advantages of using diaphragm-operated valves for several functions, the manufacturer designed the chlorinator accordingly and found materials to fit the service required. Diaphragm-operated valves are used for every pressure balancing operation. Constructed of new synthetic materials made available within the last ten years, the entire unit is completely unaffected by chlorine-water solutions. Valves, piping, fittings, and even the case in which the apparatus is housed, are completely resistant to wet chlorine.

Following the experience gained and the refinements developed through some fifty test installations made since 1949, this chlorinator was first offered for general sale in May 1952. At the same time a life test of a production-line unit was started. The test, designed to simulate the most severe conditions to be encountered in service, is still continuing with a satisfactory record of apparatus performance.

Components Long Available

In surveying the progress of chlorination equipment design (from the adaptation of mechanical and hydraulic gadgets to an integrated unit exhibiting coordinated instrument planning) one becomes aware that it has all been done before. This is said in the sense that each component used in the latest chlorinator has been successfully applied previously for other applications.

A simple chlorinating system illustrating this point is the installation made in 1940 at the St. Louis Howard Bend Water Works and described as a "Dry Line Chlorinating System" *(Water & Sewage Works)*. The essential components are a spring loaded, diaphragm-operated, mechanical, pressure regulator and a rotameter in the chlorine control room. At the point of application, a mixing injector, a water pressure regulator (to keep the chlorine flow rate reasonably constant) and a rubber solution hose are provided. Safety devices are also included.

If we go all the way back to the origin of solution feed chlorination, we find that rotameters were used by Dr. Georg Ornstein in the chlorinators he designed for the Electro Bleaching Gas Company during the years 1913, 1914, and 1915. He particularly cites their use at Tacoma, Washington, in 1913 and at Bayshore, Long Island, in 1914. The head photograph shows clearly the rotameters used on two Electro Bleaching Gas chlorinators in operation at St. Louis in 1915. The towers in the background are the solution devices which were employed before ejectors came into use for this purpose.

Speaking of the rotameters which he used as a part of his chlorinators, Dr. Ornstein says: "We abandoned them eventually because the liquid chlorine produced at that time sometimes contained gummy impurities which, when deposited on the walls of the meter tube, would cause the float to stick." Before the adoption of purification processes and improvements in the composition of the carbon anodes used in the generating electrolytic cells, liquid chlorine did

contain more organic impurities than the current commercial product.

What organic impurities are present in the commercial chlorine of today have a vapor pressure which is relatively high at atmospheric temperatures, thus they are generally carried as vapor in the chlorine gas stream. This creates a self-cleaning tendency in the rotameter and other components of the full mechanical chlorinators.

To determine the effects of organic impurities which might possibly collect in chlorinating equipment, tests have been conducted in which the entire flow system including the rotameter, was artificially given a gum coating deposited from chlorine. The subsequent feeding of municipal grade chlorine caused removal of the deposit and left the chlorinator in clean condition. Visual inspection and normal operating behavior of the apparatus, demonstrated this condition to exist after a 24-hour run.

Mention of Dr. Ornstein brings up another interesting phase of chlorinator development. In the United States no chlorinator manufacturer built chlorinators depending entirely on a non-hydraulic combination of mechnical diaphragm, spring regulators, and rotameters until 1949. Dr. Ornstein's German firm, however, did build such equipment even prior to 1949: he writes, "In my firm, Chlorator, we have been using them for many years and are still using them in particular in large installations like sewage works."

Chlorination Today

Competition in the market for chlorinators is certainly a reality today. The long dominant "hydraulic" chlorinator as exemplified by the bell jar and water tray unit has the advantage of wide market experience and a long period of field coverage. The new "mechanical" chlorinator utilizing rotameters and instrument-type regulators has the advantages of a completely closed system.

Improvement in the purity of chlorine and the invention of completely chlorine resistant materials has permitted the design of chlorinators to make a complete circuit. These conditions now allow the modern designer to do what the earlier designers wanted and tried to do in the construction of the original equipment. In other words, the principles upon which the modern mechanical apparatus operates are actually older than those of the "hydraulic" unit.

W&SW

Facts on Fluoridation Are Cited by Sensible Citizen

According to a recent report in *The Milwaukee Journal*, a sensible citizen spent considerable effort to get real facts on the water fluoridation problem—and cited them before a state legislative investigating committee.

Mrs. Dorothy Meythaler showed the assembly a full page advertisement against fluoridation which appeared in a Monroe newspaper. She told the committee her investigation revealed "this whole advertisement could be torn up like that"—and she tore the page into small pieces.

"I have the letters to prove it," she added, laying them before the committee.

Mrs. Meythaler, the mother of three children, was opposing a bill to prohibit the state board of health or any of its representatives from encouraging, recommending, advertising, promoting or advocating the use of fluorides in drinking water.

Introducing herself as "one of the little people caught in the fight over fluoridation," she told how she and her husband at first were frightened by the "scare technique" of the literature and advertisements of fluoridation opponents.

She said they charged that fluoridation made bones brittle, caused miscarriage and prompted cancer. So, she said, she wrote to some of the doctors quoted in the statements for more information.

Dr. Alfred Taylor of the University of Texas biochemical institute, Austin, was quoted as saying that his experiments with mice showed that fluoridation prompted cancer. But he assured her that the opposite was true, Mrs. Meythaler said as she placed the doctor's letter before the committee.

She said that Dr. Taylor, experimenting with 12 to 14 parts of fluoride per million parts of water compared to 1 part per million recommended for fluoridating drinking water, reported no evidence of its prompting cancer in mice.

Her inquiry regarding 119 Worcester (Mass.) physicians reported to have signed a petition against fluoridation disclosed that they signed instead a petition to have both sides of the fluoridation question presented to the public, she added.

Then she read the record of Dr. Royal Lee, Milwaukee, another of the quoted "authorities" opposing fluoridation.

She said he had been convicted of misbranding a product which he claimed "would cure 41 diseases and conditions, including goiter, Bright's disease, whooping cough, falling hair and St. Vitus dance." He also opposes cooking in aluminum pans and pasteurizing milk, she added.

"People who use scare tactics should be silenced," she declared.

Mrs. Meythaler was taunted and insulted by members of the anti-fluoridation delegation as she left the hearing room in the capitol at the conclusion of the committee's four hour session.

Water Problem Is Top Issue Among Denver, Colo., Citizens

Denverites are more concerned about water than they are about any issue in the 1955 municipal elections, a city-wide poll taken for *The Denver Post* by Research Services, Inc., indicated recently.

In a cross-section survey, pollsters asked: "What do you think is the most important problem the city of Denver has today?" The replies were:

Most Important Problem—	Percent
Water	37 pct.
Traffic	24 pct.
Juvenile delinquency	8 pct.
Housing	5 pct.
Schools	5 pct.
Public transportation	3 pct.
Sewers, sanitation	2 pct.

Three of every 10 who singled out water as the priority problem said they believe the solution lies in obtaining water from the western slope—from the Blue River or the Colorado River—or in digging more wells in Denver. Another 1 in 10 felt the city should stop selling water to suburban communities. Less than 1 in 20 said the water bond issue is the solution. Four out of 10 had "no idea" what could be done to solve the problem.

Friel Elected President of Penna. AWWA Section

Announcement has been made of the recent election of Francis S. Friel as president of the Pennsylvania Section, AWWA. Mr. Friel, president of Albright & Friel, Inc., is also president of the American Institute of Consulting Engineers.

W&SW

Water Service and What It Costs

3—Completely Adequate Treatment Facilities

by E. H. ALDRICH

Mr Aldrich is Vice President and Chief Engineer, American Water Works Service Co., Inc., Philadelphia, Pa. In this paper he describes the processing elements in normal water treatment plants, and reviews the physical requisites of capacity and dependability necessary in an adequate facility.

A Symposium of Papers on Water Service And What It Costs

Mr. Aldrich's is the third of four papers comprising a symposium on "Water Service and What It Costs" presented at the Annual Meeting of the Pennsylvania Water Works Association in Atlantic City, N. J., in October 1954. The first paper, by Abel Wolman, was published in our March issue; and the second paper, by F. S. Friel, was published in our May issue. The last paper in the series, to be published shortly, is titled:

A Completely Adequate Distribution System

BEFORE THE COST of completely adequate and satisfactory water treatment facilities can be known, two prerequisites are required. First, we must know what constitute the processing elements in a normal water treatment plant. Next we must define what is meant by a "completely adequate processing system."

A water works system can be broadly separated into three main subdivisions; namely, its (1) collecting, (2) processing and (3) distributing elements. The accompanying chart shows pictorially the principal component collecting and processing elements in modern water works systems. Few, if any, treatment plants include all the elements shown thereon. The facilities required in each plant depend upon local conditions, the source of its water supply and the requirements of service.

The second principal subdivision of a water system, the processing works, requires certain facilities which receive the raw water from the supply source and prepare it in the required amount by such changes in its character and condition as to secure a product which will pass the recognized standards of quality before its introduction into the distributing system for customer use.

Source Determines Treatment

The amount and type of preparation or treatment of the raw product will vary in practically every plant. Some supplies require little or no treatment, other than chlorination; others require a number of complex treatment steps which may include softening.

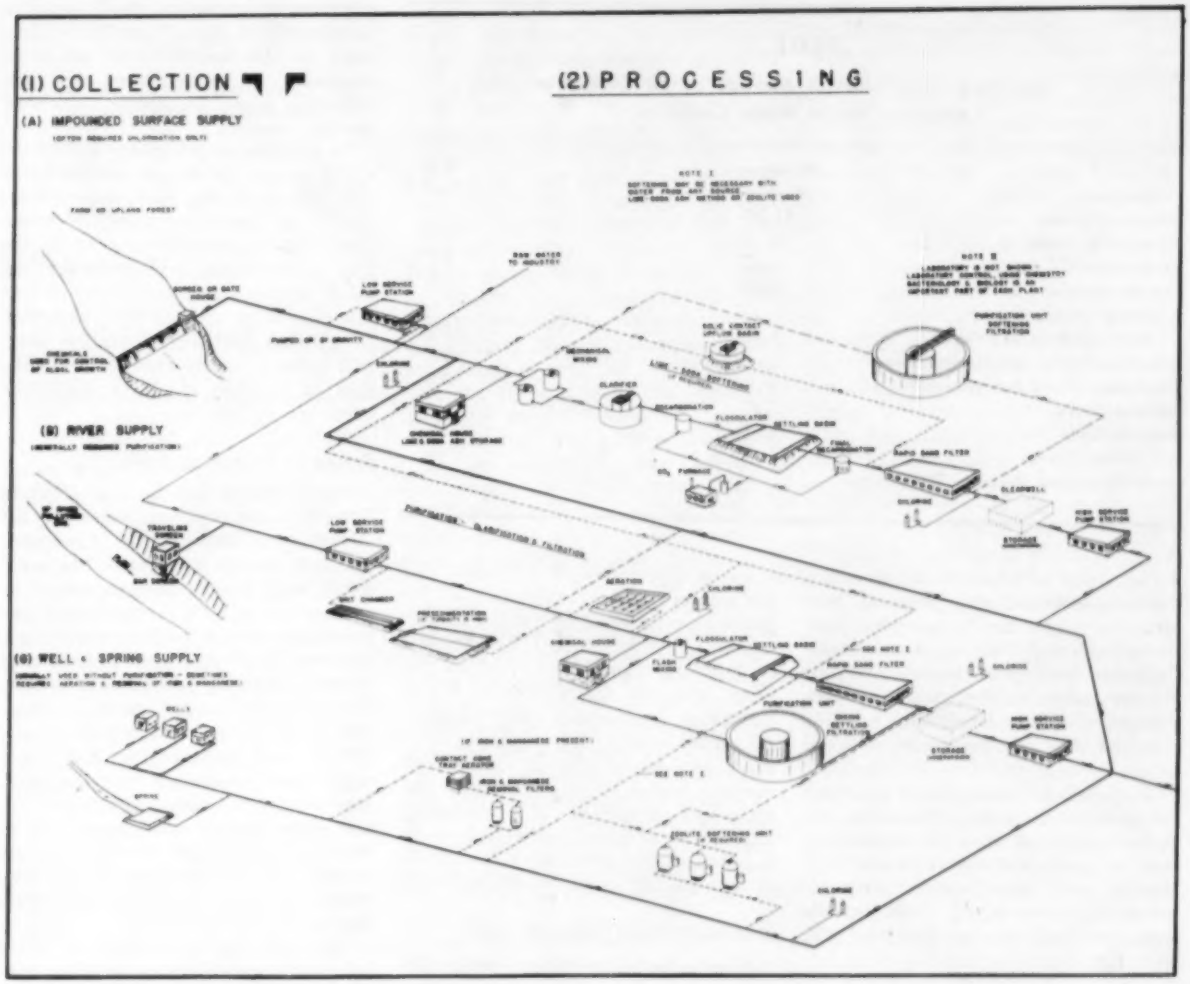
River and impounded surface supplies generally require rather thorough treatment, including screening, sometimes aeration and presettling, chemical additives and mixing to assist in coagulation and settling, filtration through sand and finally chlorination, before they meet present day standards of quality and chemical characteristics.

Supplies secured from springs, wells and other underground sources, on the other hand, generally require little preparation and sometimes can be served without any processing whatever. Most ground water sources contain excess hardness, iron or manganese, carbon dioxide or other gases which must be eliminated or brought within acceptable limits before such water can be delivered to the customers.

Present day requirements increasingly demand that the supply be softened, if the hardness is excessive, and that the final product be substantially free from turbidity, color, iron and tastes and odors, and be suitable for general industrial use. In other words, not only must the final product be of approved quality, safe from a health standpoint, and adequately meet the needs of the home, industry and commerce, but it must be esthetically acceptable as well. In recent years even supplemental treatment, such as the addition of fluoride for the reduction of dental caries, has come into accepted practice.

Since satisfactory service from the distributing system requires that the water be delivered in adequate quantities and at suitable pressures for all general purposes, this requires in most cases that the water be elevated by pumping to secure the requisite pressures throughout the system.

The raw water supply is customarily delivered to the processing facilities by gravity or by pumping after screening out the debris and major foreign matter. In most plants processing water from surface sources, the facilities now almost universally consist of a treatment plant, finished water storage and a high service pumping station and equipment. Fortunate it is if such plants can deliver their prepared water by gravity. A few



COMPOSITE representation of water collecting and processing facilities. By Eng. Dept. of Amer. Water Works Service Co., Inc.

cities having protected upland supplies still introduce the water into their systems with little other treatment than disinfection by chlorination. However, as the drainage areas of these supplies become more populated and built-up, treatment by modern filtration becomes more imperative.

Processing System Requirements

Before cost can be computed it is necessary to define what is meant by "a completely adequate processing system." If these words are to be taken literally it would mean a systen which has a capacity sufficient to prepare and deliver to the distributing system all the water demanded by its customers, at all times, at pressures suitable for their needs. The product of such a system should certainly pass the necessary health standards, be generally acceptable for industrial and commercial use and be esthetically satisfying according to present day requirements. The facilities for such preparation should furthermore be provided in such sizes, capacities and numbers and have such dependability as to be proof against interruptions in service from any cause whatsoever. A final and very important requisite should be that the operating personnel and their supervisors be competent and as reliable in maintaining service as the facilities themselves.

One may wonder whether such plants exist. One may even question whether such an ideal plant is necessary. If the customers demand such plant then they must be prepared to assume their share of the cost of providing such service.

I know of no better standards for sufficiency and reliability of these elements of service than have been developed over the years by the National Board of Fire Underwriters and which are set forth in its "Standard Schedule for Grading Cities and Towns of the United States with References to Their Fire Defenses and Physical Conditions." It is true these standards have been developed largely from the viewpoint of the fire protective ability of these facilities of a water system. But these requirements for facilities and service have been superimposed upon the maximum demands of normal service, and if these dual purposes are achieved then a fully adequate, satisfactory and reliable processing system will surely have been secured.

Volume to Meet Demands

The satisfaction of the required grading schedule in full is designed to provide reliable and adequate fire protection at the time of the maximum daily demands of its customers. These maximum daily demands are based in part upon the assumption that the maximum daily service of water is at least 50 per cent in excess of the annual average requirements.

TABLE 1

Operating Costs—Annual Average of 63 Companies American Water Works Company

Description	Per Average Customer		% of Total
Source of Supply	$1.29		4.0
Power and Pumping	6.13		18.8
Purification	2.67		8.2
Transmission and Distribution	3.34		10.2
Customer Accounting, Administration and General	7.18		22.0
Total Operating and Maintenance		$20.61	63.2
Depreciation and Amortization		2.55	7.8
General Taxes	5.55		
Income Taxes	3.92		
Total Taxes		9.47	29.0
Total Operating Revenue Deductions		$32.63	100.0

In all cases of application the actual consumption for the previous year shall be taken as the average consumption, and the maximum consumption for any 24 hours in the past 3 years taken as the maximum consumption, unless conditions have so changed that this maximum will not recur.

Required fire flows, to be provided in addition to other demands, are based largely on sizes of community, that is population, adjusted for residential and other specific requirements of lesser degree. The formula used for determining the total fire flow is:

$$G = 1{,}020\sqrt{P(1-.01\sqrt{P}}$$

where G equals gallons per minute and P equals population in thousands. Communities of 6,000 and above must be able to furnish the maximum requirements for the period and the required fire flow for 10 hours duration. Communities below 6,000 require lesser duration of flows with a minimum of 4 hours for a population of 1,000.

The United States Public Health Service has adopted standards for drinking and culinary water supplied by common carriers in interstate commerce which have quite universally been accepted as desirable for bacteriological quality and physical and chemical characteristics. The last revision of these standards has been used generally in evaluating the quality and safety of water and water supply systems. It follows that if the processing system furnishes a product from approved facilities which will meet these standards such a supply will be deemed adequate and satisfactory from the quality standpoint.

From this review, it is evident that the capital and operating costs of the processing facilities of a water system can vary widely. Some 115 companies of the American Water Works Company and the Northeastern Water Company, represent a range of small to medium-large water plants in a large area in the United States, with varying types of raw material and treatment processes. The operating experience of these companies can, it is believed, be considered a fair cross-section of the water works industry.

Treatment Plant Capacity Costs

The value of buildings, structures, pumping and purification equipment representing the processing elements of a water system will generally vary between 15 to 25 per cent of the total fixed capital devoted to water service. The elements of plant processing surface water supplies, including the treatment and pumping facilities and equipment, with a moderate amount of clear water storage to equalize the hourly rates of production, at the present time cost generally in excess of $100,000 per million gallons of daily capacity. In plant sizes up to 10-mgd capacity very few conventional filter plants can now be built for less than $150,000 per mgd capacity, and smaller units cost up to double this unit cost. In fact, in sizes of plants to 50-mgd capacity almost none are now being built for less than $100,000 per mgd.

The cost of developing well or other underground sources of supply may range between a low of about $30,000 per mgd capacity for those requiring no treatment, to costs approximating those for treating surface supplies when full treatment by filtration is required. Well supplies, particularly if ground source is abundant, in the smaller sizes of plant generally can be developed at a considerable saving in capital costs over surface sources.

In addition to providing and amortizing the cost of the production facilities, the operating costs must be included to determine the total costs. These costs generally consist of the cost of chemicals, fuel or power and other supply costs, maintenance and labor costs as well as the proportion of general and administrative costs and taxes properly chargeable to the cost of production. Here again the costs are variable.

Range in Operating Costs

For instance, for the year 1953, in the 63 operating companies of the American Water Works Company, fuel and energy costs varied between $4.35 and $81.58 per mg, with an average of $16.70. Total power and pumping costs, including labor, ranged between $5.58 and $143 per mg produced, averaging $30.40 in producing 143 billion gallons of water. Purification costs varied between $2.54 and $77.55, with an average of $13.10 per mg. Total processing costs, consisting of purification and pumping, therefore averaged $43.50 per mg of water produced and amounted to approximately 27 per cent of the total operating revenue deductions, totaling nearly $24,000,000.

It might be of interest to show what the several costs entering into the annual average customer cost of operation were in those companies during 1953. These costs are listed in Table 1. From the tabulation, it can be seen that the cost of processing the water totalled $8.80 per average consumer. Expressed on a different basis these costs totalled $43.50 per mg of water produced and $53.80 per mg of water sold.

It might be pointed out that the costs of treating and pumping the water, including labor and all direct costs, which of course have increased steadily the past five years, has decreased in percentage of the total operating revenue deductions from 31.5 per cent to 27.0 per cent in the same period. Taxes have shown a steady increase in total, and in percentage from 26.4 per cent to 29.0 per cent. In other words, while costs of processing the water have increased the percentage of these costs to the total has decreased.

To arrive at the total cost of processing the water the operating costs, including their fair share of general and administrative costs and taxes,

TABLE 2

Production Costs—Alexandria, Va.
(Supply Costs are included)

Production Costs	Total
Operating Costs	$304,400
Return	139,300
	$443,700
Water Pumped, MG	4,045
Water Sold, MG	3,572
Cost of Production	
Per 1,000 Gallons Pumped	10.9 cents
Per 1,000 Gallons Sold	12.4 cents

should be added to the capital costs involved in this element of service. Here again any figures which might be put forth to represent the total processing costs would represent at best only a very approximate cost subject to considerable variations from plant to plant.

As an example of the determination of such total costs, we can take a plant wherein was constructed within the past five years a complete new supply and processing works. This new plant at Alexandria, Virginia, processes a surface supply in a modern treatment and pumping plant. Unfortunately the supply costs are included in the analysis and cannot easily be separated. The plant was built in the existing high cost era, so may be considered to reflect a depreciated reproduction and an original cost basis for determining the capital costs. Also, although not earning a full 6 per cent return at present, the developed costs are based on a 6 per cent return. Operating costs are based on actual figures. The unit cost of processing the water is illustrated in Table 2.

It should be emphasized that the cost figures expressed herein are those resulting from the operation of a tax-paying, non-subsidized, privately owned water utility. Obviously there are certain elements of cost under municipal or other governmental operation of water utilities which would be substantially different. Private water companies customarily finance themselves with both debt and equity capital carrying a different rate of interest. Private companies must generally provide all their funds for acquiring and constructing property and for working capital. They must pay substantial general, Federal, and state income taxes. Publicly owned utilities can be and usually are financed through taxes, assessments and indebtedness, and because of the tax-free status of the debt capital, the interest rates realized are generally lower. There can not be, therefore, a direct comparison between privately and publicly owned utility processing costs because of the different bases upon which they must be computed.

Little has heretofore been said regarding the operation of an adequate and satisfactory processing system. It goes without saying that the operating and supervisory force and procedure must be such as to insure satisfactory and reliable service. Successful operation requires the technical skill and the application of a great amount of "know-how" to insure the delivery of a product of approved quality in sufficient quantities and under adequate pressures at all times.

It has previously been indicated that few, if any systems, can qualify in all respects and in all elements as a "completely adequate and satisfactory processing system." For one thing what may be adequate this year may, under changed conditions, be entirely inadequate and deficient next year. Most plants in the early 1940's were circumscribed in keeping up with the growth in service by lack of the necessary materials and labor and did not keep pace with the demands. Even now it must be admitted that many plants have not caught up with or kept up with the unprecedented and unlooked for housing growth which most communities have experienced in the past five to ten years.

And per capita use of water continues to rise. Indications are that such growth and increase in use will continue at least for the next ten years. As a result probably few systems approach what might be termed completely adequate, reliable and satisfactory service. How many additions to plant and how much money would be required to produce such a state of service, it is difficult to assess even on an approximate basis.

Seasonal as the water business is, and faced as it is with heavy sprinkling loads in drought periods and with wasteful air conditioning loads in hot periods, generally superimposed one on the other, it may be advanced if moderate restrictions in use during such peak periods should not be imposed or such use somewhat controlled by higher charges to continue to render service at the lowest possible cost and satisfaction to all. Generally, periods of peak demand occur infrequently over the years and for durations of only a few days a year. These rare restrictions in use would mean that service was not fully adequate and satisfactory. But the imposition of sprinkling restrictions, say on one side of the street one day and the opposite side the next, or the alternation of such restrictions with even and odd numbered houses, would cause very little inconvenience and no damage to any customer.

To satisfy the requirements of all customers at all times will assuredly cost more money and they must pay for the cost of such additional facilities year in and year out, every day of the year. What such additional cost of service, to be 100 per cent proof against any deficiencies at all times, would amount to, would be largely a guess. It may well cost 10 to 20 per cent more to provide the additional capital facilities for completely adequate service and some leeway for contingencies. While this may not seem large it still adds appreciably to the costs which the customers must pay. At the same time in a privately owned utility, it would require an additional payment in income taxes.

It is becoming increasingly difficult to obtain the money necessary to finance new facilities. Such money must be forthcoming in advance of rate increases in the case of private utilities, and earnings must be adequate to secure it at a reasonable rate. Similar difficulties of raising money apply as well to municipal financing, where there is considerable competition with demands for new municipal facilities of all kinds; (schools, hospitals, highways, sewers, housing and the like). In fact, the cumulative effects are becoming so heavy that the time may be approaching when the fountain will dry up, or the municipalities will become so committed with capital payments that an onerous burden will be imposed upon its inhabitants as well as their successors for many years.

Stream Sanitation Research Conference Scheduled

The Gordon Research Conferences, Amer. Assn. for the Advancement of Science, were established to stimulate research in universities, research foundations and industrial laboratories. A Conference on Stream Sanitation is to be held June 20 to 24 under AAAS sponsorship, at Kimball Union Academy, Meriden, New Hampshire.

J. Carrell Morris will be chairman, and Clair N. Sawyer will be vice-chairman. This is an informal type of meeting, consisting of scheduled lectures and free discussion groups.

For details of the Conference address George W. Parks, Director, Colby Junior College, New London, New Hampshire.

Designing, Constructing and Maintaining Centrifugal Pumps

Part 6—Pump Shafts

by ROY CARTER and IGOR J. KARASSIK

Mr. Carter is manager of the Volute Pump Section, and Mr. Karassik is manager of the Multistage Pump Section, Centrifugal Pump Division, Worthington Corp., Harrison, N. J. This new series has been prepared by Messrs. Carter and Karassik to review characteristics of centrifugal pumps for water and sewage service.

THE BASIC functions of the shaft of a centrifugal pump are: (a) to transmit the torques encountered both in starting and in operation, and (b) to support the impeller and other rotating parts with a deflection less than the minimum clearance between rotating and stationary parts.

The loads involved are (1) the torques; (2) the weight of the parts; and (3) hydraulic forces, both radial and axial. In designing the shaft, the maximum allowable deflection, the span or overhang, and the location of the loads all have to be taken into consideration, as well as the critical speed of the resulting design.

Theory vs. Practice

In conventional designs of centrifugal pumps, the resulting assembly is theoretically uniform around the axis of the shaft and thus the center of mass should coincide with the axis of rotation. This condition cannot be realized for two reasons. First, there will be minor irregularities in machining or in the castings and, second, there will be variations in the density of the metal of which each part is made. Thus, even in vertical shaft machines where there is no radial deflection due to the weight of the parts, this eccentricity of the center of mass will result in a centrifugal force when the assembly rotates. At that speed at which the centrifugal force exceeds the elastic restoring force, the rotor will vibrate as if it were seriously unbalanced; and if run at that speed without restraining forces the deflection will increase until breakage of the shaft occurs.

Actually the critical speed of a shaft can be reached and passed without danger, as there are frictional forces that restrain the deflection. In centrifugal pump operation, these frictional forces include the surrounding liquid, the stuffing box packing, and the various internal leakage joints acting as internal liquid-lubricated bearings. Once the critical speed is passed, the rotor will again run smoothly up to the second speed corresponding to the natural frequency —and so on for the third, fourth, etc., critical speeds.

Rigid and Flexible Shafts

In centrifugal pumps, designs rated for 1750 rpm or lower speeds are usually of the "rigid shaft" design: that is, the shafts have a higher critical speed than the pump operating speed. On the other hand the high head, 3000 rpm or higher rotative speed multi-stage, pumps (as made for boiler feed service) generally employ "flexible shafts"—with the pump operating speed being above the first critical speed.

At first thought, one might wonder how it would be safe to start a pump having a flexible shaft and bring it up to full speed if it has to pass thru the first critical speed. This can be done for two reasons. First, the time required to attain full speed from rest is small so the time required to pass thru the critical speed is very short. Second, as previously mentioned, above, the liquid in the pump, the packing in the stuffing boxes and the internal leakage joints in the pump, all act as restraining forces to limit vibration.

Because of internal clearances at the wearing rings, etc., it is generally desirable to limit the shaft deflections under most adverse conditions to 0.005 to 0.006 inches. Since there exists the relation that the first critical speed is 187.7 divided by the square root of the resulting deflection, it follows that a shaft design permitting a deflection of 0.005 to 0.006 inches will have a first critical speed of 2400 to 2650 rpm. This explains the selection, as mentioned previously, of rigid shafts on 1750 rpm or lower rated speed pumps, and flexible shafts on 3000 rpm and higher multi-stage pumps.

Summing up, it can be said that as long as the operating speed is sufficiently removed from the critical speed, and as long as the shaft deflection is properly taken into consideration in setting the running clearances, it matters very little whether the first critical speed is above or below the operating speed. A well-balanced pump having a flexible shaft is a safer piece of equipment than a poorly balanced, rigid shaft pump.

Pump Shaft Design Details

Shaft diameters generally are in excess of the dimensions actually needed to transmit the torque. This, incidentally, is as it should be, for ease of assembly demands that the shaft diameter be stepped up several times from the coupling end to its center where the impellers are to be mounted.

Figure 1, which shows a typical shaft assembly for a single-stage pump, illustrates this construction. Starting with the maximum diameter at the impeller mounting, there is a step-down for the shaft sleeve, a second for the external shaft nut, followed by several more steps for the bearings and the coupling. It is clear, therefore, that the shaft diameter at the impellers not only exceeds that required at the coupling for torsional strength, but care must also be taken in the design to provide sufficient diameter difference for the necessary steps.

Frequent exceptions to the oversizing of the shaft at the impeller mounting are those units made up to two double-suction single-stage pumps operating in series, when one of the pumps has a double-extended shaft. Since this pump has to transmit the total horsepower for the entire series unit, the shaft diameter at its inboard

bearing may have to be increased in excess of the normal diameter.

The shaft design of end-suction, overhung-impeller type pumps presents a somewhat different problem. One of the solutions used to reduce the shaft deflection at the impeller and at the stuffing box (where the concentricity of running fits is extremely important) consists of increasing the shaft diameter very appreciably between the bearings, as illustrated in Fig. 2. This design, incidentally, permits shortening the shaft span between the bearings and results in a more compact unit.

Function of Shaft Sleeves

Except in certain smaller sizes, centrifugal pumps usually are protected against wear, erosion and corrosion by renewable shaft sleeves. By the use of shaft sleeves, wear, erosion and corrosion do not affect the strength of the shaft, and the cost of maintenance is reduced. There are many forms of shaft sleeves used in centrifugal pumps, the most common being those used to protect the shaft where it extends thru a stuffing box. Generally sleeves serving other functions are given specific names to designate their purpose.

Shaft sleeves will be discussed in detail later. They are mentioned here only because in extremely small size pumps the use of shaft sleeves presents a certain disadvantage. Since the shaft sleeves cannot contribute to the strength of the shaft to any appreciable degree, the shaft itself must be designed for the full maximum stress. The shaft diameter is then increased very materially through the addition of the shaft sleeve, since the thickness of the latter cannot be decreased beyond a certain safe minimum. As a result, the impeller suction area may become dangerously reduced, unless the eye diameter is increased to maintain a constant eye area, which in turn increases the pick-up speed unfavorably. Further disadvantages result from increased hydraulic and stuffing box losses caused by an increase in the effective shaft diameter out of proportion to the small size of the pump.

Resistant Materials for Shafts

In order to eliminate such shortcomings, very small pumps are frequently furnished with shafts made of stainless steel or other material which has metallurgical properties of corrosion and wear resistance sufficient to permit satisfactory operation without shaft sleeves. Such a pump is illustrated in Fig. 3. It must be noted that this also leads to a less expensive construction, and that the cost of replacing the shaft when it is sufficiently worn is of the same order of magnitude as the cost of new sleeves plus cost of their installation.

The question is sometimes raised as to the stiffening effect of impeller hubs and shaft sleeves. These do contribute towards making a stiffer assembly.

As previously mentioned, stuffing boxes and internal leakage joints act as bearings which aid in supporting the rotor. Some designs depend on these aids, and the pumps start to vibrate when the leakage joints or packing become worn.

Pumps using mechanical seals (which will be discussed later) instead of stuffing boxes should have stiff shafts, as deflection should be kept to a minimum.

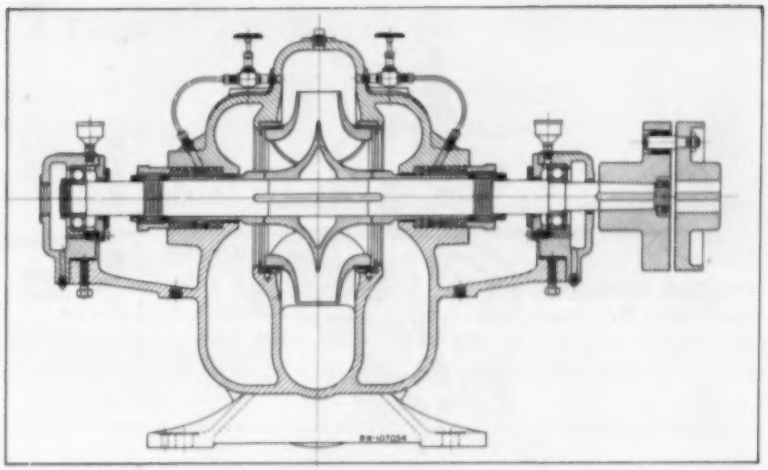


Fig. 1—ROTOR ASSEMBLY, single-stage double-suction pump

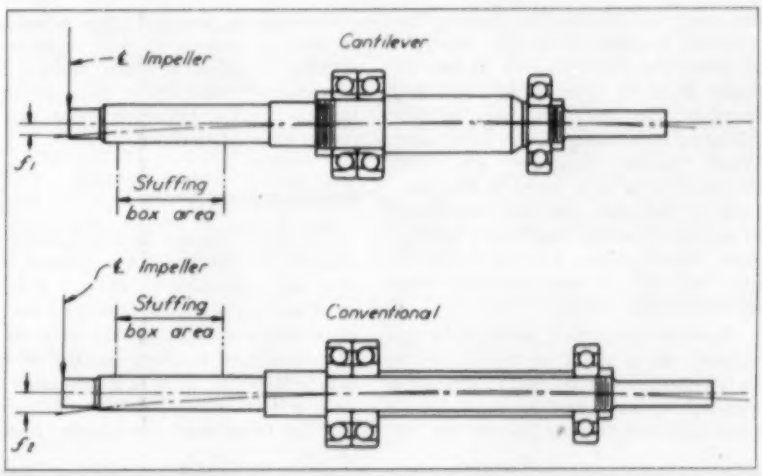


Fig. 2—COMPARATIVE design characteristics of "cantilever" and conventional shaft types of end-suction overhung impeller pump

Maintenance of Shafts

Except for the small no-shaft-sleeve pump design mentioned above, it is unusual to replace the shaft of a centrifugal pump. Naturally, there are casualties resulting from damage due to failure of some other part and a new shaft must be obtained or the old repaired. Generally, however, it is expected that the shaft will last as long as the pump.

Points Vulnerable to Damage

If a pump is dismantled for overhaul, it is advisable to examine the shaft carefully for any sign of wear or irregularities. It should first be checked at all the important fits, such as at the impeller hub bores, under the shaft sleeves, and at the bearings. In some cases the shaft may have been

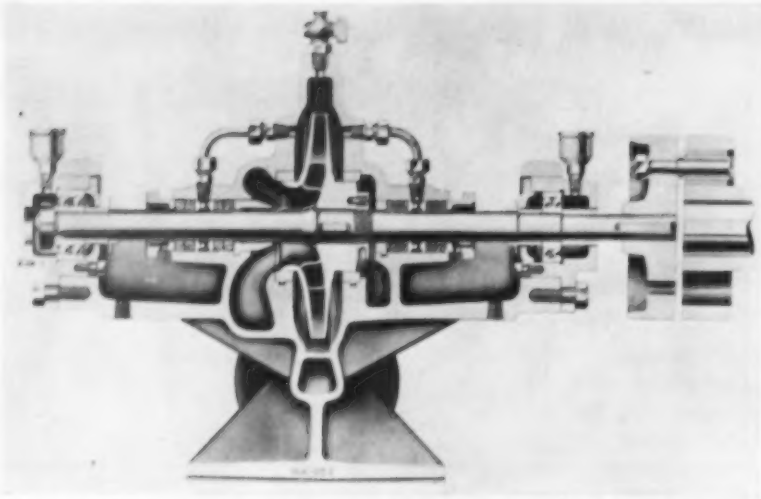


Fig. 3—PHANTOM section view, small size centrifugal pump of a type not equipped with shaft sleeves

damaged by rusting or pitting because of leakage under the impellers or under the shaft sleeves. When the pump is of a type fitted with ball bearings, the shaft may have become damaged by turning in the inner race. When Babbitt bearings are used, the shaft may have worn in the journals, or become grooved. The shaft fit at the coupling may have become loose. Small pumps having shafts not provided with sleeves may show wear at the stuffing boxes.

Another important point to be examined on a shaft is the keyways, as twisting of the shaft, excessive thermal stresses, corrosion or even a poor original fit may loosen the impellers on the shaft. If this situation is not corrected, it will aggravate rapidly. Finally, a shaft should be examined carefully for possible fatigue cracks, although these are a rather rare occurrence.

Repairs to Pump Shafts

The shaft should then be placed in centers and checked for concentricity. It is not advisable to correct a bent or distorted shaft, as the process is an extremely difficult one even in a shop equipped to carry out the necessary procedure. Nor is it advisable to weld a shaft which has been damaged, as distortion will inevitably result. Any shaft which is either bent or distorted should be replaced with a new shaft.

If the replacement cost of a new shaft is high and if facilities for such repairs are available, it may be possible in some cases to rebuild the old shaft by metal spraying and remachining. Such repairs should always be carried out with adequate knowledge of the shaft material and of appropriate metal spraying methods. After a shaft has been repaired, it must be checked for possible distortion, and then rechecked once more after complete assembly of the rotor to assure that the shaft nuts have not been tightened so excessively as to distort the shaft.

Mention was made previously that a steel shaft might, after service, be found rusted due to leakage between the shaft and the impeller or sleeves. Leakage into the shaft may even occur through the hub of the impeller if the casting is porous at that point. Such leakage is hard to control. Leakage through the metal-to-metal joint of a sleeve and the hub of the impeller is often controlled by the use of packing, as will be discussed under the subject of shaft sleeves. Often seepage or leakage of the liquid being pumped into the shaft may warrant the use of corrosion resisting material for the shaft construction in place of regular steel. For example, monel shafts are very often used for pumps handling sea water, even though the pump design provides full protection by sleeves from direct liquid contact by the shaft.

1954 Annual Report Issued by Ohio River Commission

Sewage-disposal facilities to treat the wastes from more than four million people are now in operation in the Ohio Valley. New facilities under construction or approved for an early start on construction will treat the sewage from another 3,260,000 people. This is part of the picture on pollution-control developments revealed in the sixth annual report of the Ohio River Valley Water Sanitation Commission.

The record shows that 45 per cent of the population now is served by sewage treatment, 9 per cent has treatment plants under construction and 26 per cent has plans approved for construction. Sewered population in the district is 9,322,000.

Progress in industrial waste control is revealed from an analysis of reports from the signatory states, which shows that of the 1,190 industries discharging directly into streams of the district: 361 are rated as adequate; 429 provide some form of control but more will be required; 32 new installations are under construction; and 129 new facilities are in the planning stage.

"Equally important," states the report, "is the reduction of pollution loads from thousands of industries that discharge into municipal sewer systems where treatment plants have been built.

An important adjunct to the development of control measures is the service being rendered by some 150 representatives of major industries in the valley. They are grouped into seven industry-action committees and are counselling with the Commission.

For copies of this exceptionally well prepared and illustrated report, address Edward J. Cleary, Exec. Dir. and Chief Engr., Ohio River Valley Water Sanitation Comm., 414 Walnut Street, Cincinnati 2, Ohio.

Georgia's Water Supply Low But Free of Disease

Georgia's water supply ran low in 1954, but what there was of it was clean and free from disease. This was reported by the Georgia Health Department's Division of Water Pollution Control.

No cause of disease was traced to any of the 400 city, county and industrial water systems examined during 1954, according to N. M. deJarnette, acting director of the State's Division of Water Pollution Control.

Twenty municipal systems suffered severe water shortages last summer and fall during the drought. However, the shortages had good results along with bad. "The drought caught several communities napping and caused them to dust off delayed plans for improving and expanding their water and sewage systems," deJarnette said.

A 17-Year Old Transite Sewer

Measurement of the friction coefficient "n" of a 10-inch sewage force main demonstrated the interior surface to be as smooth as when new

by T. R. GILLEN

Mr. Gillen is Assistant Manager and Sales Engineer of the Transite Pipe Dept. of Johns-Manville, New York, N. Y. His paper describes two flow tests, conducted in 1945 and in 1954, on a sewage force main in the Boro of Manville, N. J. The results reported indicate that an "n" valve of 0.010 may be used in design of a Transite sewer line.

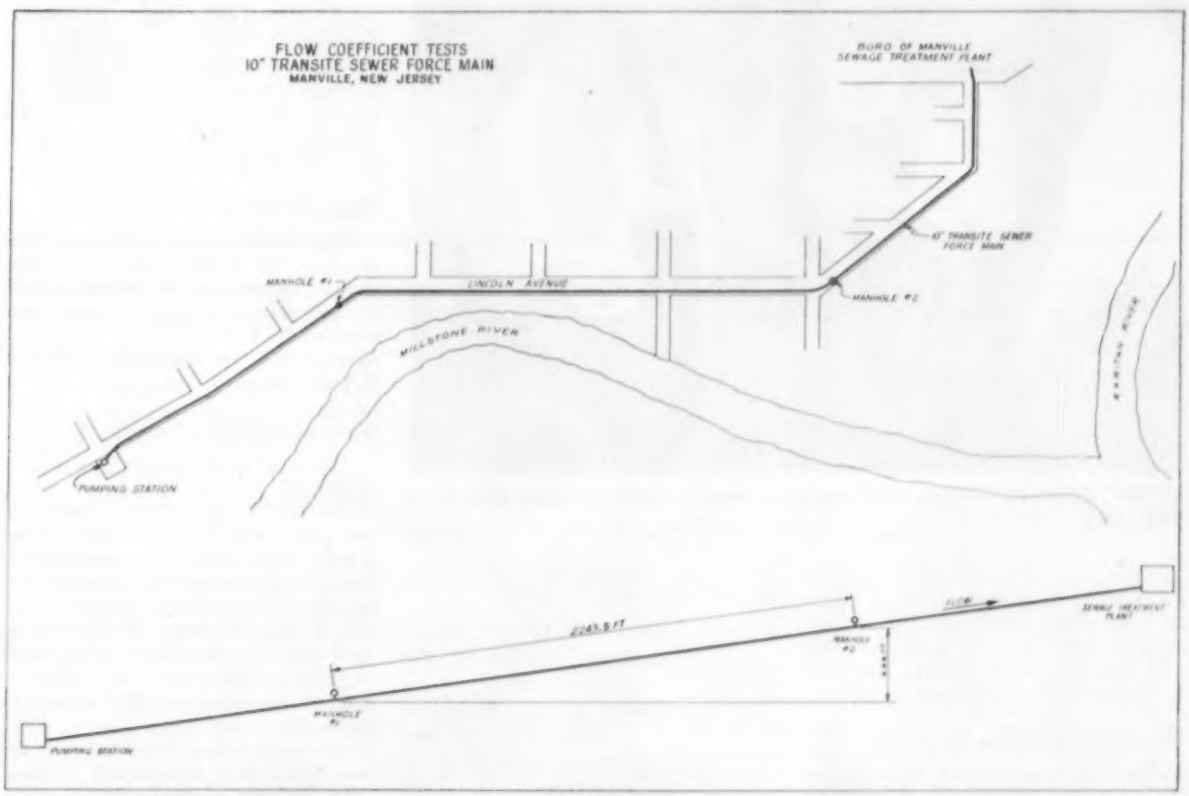
BECAUSE its flow coefficient plays such an important part in the design and economic functioning of a sewer line, it was decided to study that characteristic of Transite sewer pipe over a period of years. The formal literature on the hydraulics of sewers contains scant data on asbestos-cement pipe, so these flow tests on a 10-inch force main will be of considerable interest.

In 1937, the Boro of Manville, New Jersey, completed the first step in its program of treating all domestic sewage waste in that Boro. This date marked the start of operation of the sewage treatment plant designed to serve approximately half of the population. The plant now treats the sanitary sewage of the Boro's 10,000 population, as well as the waste from a few small industrial plants and commercial establishments. Because of the topography of the area, all sewage flows by gravity to a central pumping station at a low elevation and then is pumped through a 4800-ft.-long 10-in. Transite force main to the treatment plant located at a higher elevation.

Pressure Gaging Points Available

During construction of the force main in 1937, two manholes were located along the line to house air relief valves. These manholes, roughly 2250 feet apart, acted as access points for pressure gaging points during the tests. Changes in direction were made by deflecting successive pipe lengths, a practice made possible through the flexibility of the Transite coupling and rubber rings.

In 1945, eight years after operation commenced, flow test data were collected for the computation of "n", the Manning flow coefficient. Pressure readings at the gaging points were taken at the same time that calibrated discharge readings were recorded by the Venturi meter at the plant. From these data, plus relative elevations of the gaging points and the geometry of the pipe, computed "n" values were found to range from 0.00810 to 0.01078.



PROFILE and PLAN of the Manville, N. J., 10-inch Transite force main on which flow tests were made.

IN THE FIELD—At manhole No. 1, test observers Maahs, Zelley, Segesser, Barker, and Kachorsky (identified in text).

IN THE PLANT—Rate of flow being recorded at Manville sewage treatment plant during 1954 tests.

Tests were repeated in the summer of 1954. In these tests, after 17 years of continuous operation, "n" values ranged between 0.00946 to 0.01049. For practical purposes there has been no change in the roughness coefficient.

Determination of Flow Coefficient

The coefficient of friction of roughness, "n", is determined by Manning's formula:

$$V = \frac{1.486}{n} R^{2/3} \quad S^{1/2}$$

where V = velocity in feet per second
R = hydraulic radius of the pipe in feet
S = slope of the hydraulic gradient in feet per foot
n = coefficient of friction or roughness

Several sets of measurements were taken, both in 1945 and in 1954, to provide a check on the coefficient. These were taken at different rates of flow, by operating a 1.0 mgd pump and again by operating a 1.5 mgd pump.

Velocity of Flow (V)

In 1945 and again in 1954, it was found that the Venturi meter to which a flow recording instrument is attached, did not give a true velocity of the flow from the Transite force main to the plant. In both instances, the meter was calibrated to obtain the true flow. This was done by pumping the sewage from the line into one of the primary sedimentation tanks which had an accurately measured capacity. An accurate correction factor was determined by comparing the flow on the recording instrument, with the actual volume measured in the tank.

The velocity was calculated from the formula:

$$V = \frac{Q}{A}$$

where Q = rate of flow in cubic feet per second
A = cross sectional area of the pipe in square feet
V = velocity in feet per second

The average flow, with the 1.0 mgd pump in operation, was 770 gallons per minute. The cross sectional area of the 10-in. pipe is 0.545 feet. The average flow was found to be approximately 3.0 feet per second. Actual velocities for each test run can be found in Table 1.

Hydraulic Radius (R)

The hydraulic radius of a pipe line flowing full is the area of the pipe divided by the wetted perimeter, and is one fourth of the diameter expressed in feet. For this 10-in. line flowing full, the hydraulic radius is 0.2083 feet.

Slope of Hydraulic Gradient (S)

The hydraulic gradient is a line drawn to join the points to which water would rise in tubes attached to the pipe through which the sewage flows. In pumping the sewage uphill from the pumping station to the sewage plant, a loss of head is experienced due to the difference in elevation as well as to the roughness of the walls of the pipe. The greater the difference and/or the rougher the walls, the higher the loss of head.

The total loss of head between the two points was determined by pressure readings at each manhole. The loss of head due to the roughness of

TABLE 1

Flow Tests

Manville, New Jersey, 10" Class 150 Transite Force Main

Date	Run	Flow-Q ft^3/sec	Area-A ft^2	Velocity-V ft/sec	Hydraulic Radius-R	Manhole #1 Pressure ft of water	Manhole #2 Pressure ft of water	Diff. in Elev. Man. #1 & #2 (ft)	Diff. in Press. due to Friction Loss	Length of Line-ft	Slope ft/ft	"n"
8- 7-45	A	1.755	0.545	3.22	.2083	29.26	12.70	6.88	9.68	2255.5	.00430	.01064
8- 7-45	B	1.728	0.545	3.17	.2083	29.26	12.75	6.88	9.63	2255.5	.00428	.01078
8-10-45	A	1.330	0.545	2.44	.2083	20.26	10.17	6.88	3.21	2255.5	.00143	.00810
7-22-54	A	1.57	0.545	2.88	.2083	26.41	13.64	6.66	6.11	2243.5	.00272	.00946
7-22-54	B	2.36	0.545	4.33	.2083	43.74	20.97	6.66	16.11	2243.5	.00718	.01021
7-27-54	A	1.624	0.545	2.98	.2083	27.57	14.27	6.66	6.64	2243.5	.00296	.00953
7-27-54	B	1.620	0.545	2.97	.2083	28.59	13.94	6.66	7.99	2243.5	.00356	.01049

the walls of the pipe is determined by subtracting the difference in elevation between the two points from the total.

Pressure readings were taken using mercury manometers in 1945 and pressure gages in 1954. Readings were corrected for the height of the pressure gage fittings. Although the gages were calibrated before and after the tests, they were exchanged at the stations for one test run to assure accuracy.

Differences in elevation between the corporation stops were determined by means of level and rod. A discrepancy was found between the 1945 and 1954 level measurements. In 1945, the difference in elevation was found to be 6.88 feet. In 1954, the difference was 6.66 feet.

The length of the line was measured using steel tapes. In 1945, the line was measured to be 2255.5 feet. A distance of 2243.5 feet was measured in 1954. This shorter distance measured was the result of using a one-hundred-foot tape and measuring the chords rather than the arcs at each end.

With a loss of head due to the flow through the pipe of 6.88 feet, the slope = S.

$$S = \frac{6.88}{2255.5} = .0030 \text{ feet per foot}$$

Coefficient of Flow (n)

Using the average values of velocity, hydraulic radius and slope, as given in the above examples, the Manning "n" is calculated as follows:

$$n = \frac{1.486}{3.00} \times (.2083)^{2/3} \times (.0030)^{1/2} = 0.0100$$

Table 1 presents a summary of the observed data for each of 1945 tests and the 1954 tests. It is concluded from the test run on this 10-in. force main at the end of eight years and after nine additional years, that the Transite pipe has maintained a smooth interior surface for these 17 years of service. It can be expected that this Transite sewer force main will continue to have an average roughness coefficient "n" of 0.010.

Acknowledgment

Acknowledgment is made to Mr. M. S. Kachorsky, Borough Engineer of Manville, New Jersey, and his staff for their cooperation in conducting these tests. The July 27, 1954, tests were witnessed by Mr. S. T. Barker, Assistant Director of the Bureau of Environmental Sanitation, New York State Department of Health, together with Mr. John Zelley and Mr. E. Segessor, Senior Engineers of the New Jersey State Department of Health.

Army Adopts Fluoridation After Long Study

The army medical service has conducted long studies on the benefits of fluoridation of water supplies to the teeth of growing children. The result: Water supplies at army installations which have no natural fluorides will be fluoridated.

The army, of course, doesn't expect fluoridation to do a great deal for the teeth of old buck sergeants or even of 18-year old draftees. But the army is responsible for thousands upon thousands of children—the dependents of army personnel. It provides schools, quarters, medical attention and other services for them. Now it has decided that those children should get the benefits of fluoridation–

New Joint Authority Plant in Delaware County, Pa.

H. E. Moses, director of the Bureau of Sanitary Engineering, Pa. Dept. of Health, represented the Sanitary Water Board at the recent dedication ceremonies of the Muckinipates Joint Authority sewage treatment plant. The plant provides sewage treatment for the boroughs of Clifton Heights, Glenolden, Norwood and Folcroft, and Springfield, Upper Darby, Darby and Ridley townships in Pennsylvania. It was built at a cost of more than $2 million and is designed to treat a flow of 3 mgd.

This is the second of the three joint authority sewage treatment plants under construction in Delaware County to be placed in operation.

Australia Studies Chemical Seal To Reduce Reservoir Evaporation

The Commonwealth Scientific and Industrial Research Organization is reported to be experimenting with cetyl alcohol, a waxy substance that is the base for cold creams, detergents and "wetting agents," as a means of reducing the enormous loss of water caused by evaporation from Australian reservoirs.

Scattered over areas of water in crystal form, this chemical which costs only one half-penny a thousand gallons of water treated, forms a thick film that covers the water's surface and reduces evaporation.

In a trial on a pond of two acres the evaporation was apparently reduced 30 per cent, but the tests were complicated by seepage and other factors. Tests of larger storages are now planned.

Fourth Southern Waste Conference Held at Duke University

Report on the Fourth Municipal and Industrial Waste Conference sponsored by North Carolina University, State College, and Duke University

by NELSON L. NEMEROW

Mr. Nemerow, Associate Professor of Civil Engineering, North Carolina State College, was moderator at the conference session devoted to textile waste problems. The photographs were provided by J. W. Williams, Acting Chairman, Dept. of Civil Engineering, Duke University.

REPRESENTATIVES of industries and municipalities—a total of 250 administrators and engineers—attended the Fourth Southern Municipal and Industrial Waste Conference held at Duke University on March 31 and April 1. These annual Conferences are jointly sponsored by North Carolina State College, the University of North Carolina and Duke University and are supported by several of the Southeastern States. The theme of the 1955 Conference was "The Role of Water Resources in the Future of the South."

General Herbert D. Vogel, Chairman of the Board for T.V.A., presented the keynote address on "Water Resources and the Future of the South." He stated that a solution to our water shortage difficulties can be approached by constructing storage reservoirs to effect better distribution in time and space, but that in the last analysis we will always be dependent to some extent upon the meteorology of the region. Our real problem is to determine how the available streams should be used, or shared, to render the most benefit to the most people.

Learning how to share the benefits equitably he emphasized as the core of the problem. The State must serve as arbiter so that each group representing a conflict of interest in usage will get its equitable share in our greatest natural resource. The polluter should not be required to remove the last traces of pollution from his waste but, on the other hand, he should not expect to use the stream exclusively for his own benefit. General Vogel advocates an adaption of the Golden Rule, "do unto others downstream as you would have those upstream do unto you." In following this rule the Southeast may prevent the development of situations that will call for really drastic actions a decade hence.

First luncheon speaker at the conference was Colonel William A. Hardenbergh, Editor of *Public Works*. According to Colonel Hardenbergh, at least one-sixth of our communities have suffered more or less serious water shortages over the past two years. He attributed these and other pending shortages to the rapid population growth, changing habits of water use, and increased industrial development. Our nation will use twice as much water 25 years hence as the 175 billion gallons per day that we are now consuming. The greatest part of our present water use is for irrigation, while only about 10 per cent is for municipal use. Col. Hardenbergh challenged research and educational institutions to propose a prompt, full, and sound development of our natural resources in water, including both procurement of adequate supplies and conservation of what we have.

Panel Discussion on Resources

A panel discussion of "Water Resources and the Development of the South" was presided over by Robert E. Stiemke, Director of Civil Engineering at Georgia Institute of Technology.

Dr. W. W. Stevens of the Federal Soil Conservation Service spoke on "Agriculture and Southern Waters." This is the first time that agriculture has had a voice in these Conferences. Dr. Stevens stated emphatically that no use of water other than human consumption should receive greater priority than irrigation. He presented considerable data on agricultural uses of water in North Carolina. The following approximate estimates are pertinent:

Rural human needs	285 mgd
Livestock	41 mgd
Irrigation (about 14" on 17,859 acres, 120 billion gallons per season)	
Spray and planting	250 mgd

In the Piedmont area, well yields are low and reliance for irrigation water is placed on farm ponds where large streams are not available. There are about 21,000 farm ponds in North Carolina, with an estimated total capacity of 47 billion gallons, which represents about 10 per cent of the estimated need. In the coastal plain area, well yields are usually satisfactory for irrigation.

Dr. Stevens visualized growing competition for water, between human, agricultural, and industrial interests, and concluded that water will have to be allocated on a priority basis to humans, agriculture, and industry.

The Perfect Water Site

F. Clifton Toal, Assistant Vice-President of Industrial and Agricultural Development of the Southern Railway System, described the "perfect" water site: One having a large acreage of level, flood-free land, with excellent bearing surface; bounded on one side by a railway; on another by a stream carrying an unlimited quantity of virtually distilled water; on a third side by a high-tension power line; and on a fourth side by a prominent highway affording top advertising value. The site should be located outside but relatively close to a substantial community which contains all necessary facilities and cultural advantages. A single owner, willing to sell at a reasonable price finishes off this picture-book site.

Mr. Toal listed and described some of the threats to good water sites as dams, relocated highways, cemeteries, and property owners unwilling to sell. Industry is beginning to look for ground water rather than surface

water sites. Of all the many uses of water, the railroads are most interested in the industrial use. The importance of this usage goes to the heart of the South's economy. The railways would like to see a course of action followed which will not on the one hand keep industry out of the South and will not on the other hand so pollute our streams as to interfere unreasonably with other uses of water—and thus diminish the number of industrial water sites which are usable.

OPENING SESSIONS—General Herbert D. Vogel, keynote speaker; President A. Hollis Edens, welcoming address; Walter J. Seeley, presiding; and Capus M. Waynick, banquet speaker.

LUNCHEON SPEAKERS—On first day, Col. W. A. Hardenberg, General Vogel, Professor J. W. Williams, and Mr. Kenneth J. Tharp; on second day, Paul M. Gross.

Water and Power Generation

Mr. O. J. Miller, Vice President and General Manager of Duke Power Company, presented the power companies' part in the picture. He reminded the audience that water resources for production of electrical energy are a vital part of industrial development. The hydroelectric potential of North Carolina is entirely inadequate for her needs; however, the water requirement of steam-electric power plants is but a fraction of that of hydro plants. Even with the decreased water requirements of steam plants, a 1,000 kw plant will require a water flow of about 1200 cfs.

The prospect of utilizing atomic energy offers little hope in reducing water requirements, since it is anticipated that the nuclear power plant now being built will require 50 per cent more water than a steam plant of the same capacity.

The Piedmont area has many small and medium sized streams, but no large ones. The rainfall is fairly high, and is moderately well distributed seasonally. The yield per square mile varies from 1.0 to 1.5 cfs. The area has no large cities; thus, with adequate storage for periods of low flow the water resources should prove adequate for the present.

The Duke Power Company is engaged in an intensive program of soil and water management, which consists of water storage, soil conservation, forestry, and farming for the purpose of watershed protection. This type of program is considered to be of vital importance in the ultimate development and growth of the economy of North Carolina.

Regulating Water Resources

R. Graham Waitt, Attorney, Atlanta, Georgia, spoke on "The Need for Regulation of Water Resources." The need for regulation of water resources depends on several factors: (1) supply of good water for all needs; (2) the existence of a present law promoting desirable growth and expansion in municipalities, industry and agriculture; and (3) the readiness of the people to accept the State's assumption of control over all water in the State. He believes the need for regulation of water resources in any state will depend upon a very careful and searching inquiry of these three factors.

Philosophy of Water Use

Scott B. Berkeley, Mayor of Goldsboro, North Carolina, and a Municipal Member of the State Stream Sanitation Committee set forth four philosophies:

(1) That all needs, rights, and uses in our social and economic order —present and future—be equitably administered.

(2) To carry out the system of classifications with sound and level-headed thinking, based upon careful scientific study and reports by experts.

(3) Frankness with one another concerning matters of vital, common needs inevitably will generate solutions which will be for the greatest good for all.

(4) North Carolina must be and is realistic concerning preservation of her water resources; this must be carried out with the spirit and will of her people.

Banquet Speaker Discusses Law

The honored banquet speaker was Capus M. Waynick of High Point, North Carolina. He wisely stated that the acute water shortage which distressed and alarmed a number of North Carolina cities last year had one compensating effect: It spread enlightenment and heightened public concern about what engineer-experts in water have been trying to tell us. The failure of municipal water pressure placed some helpful public pressure behind needed legislation.

Mr. Waynick quoted several passages from the new law amending the National Water Facilities Act and reminded the audience that this new legislation does not relieve the State of any part of its responsibility for initiative or forceful action on a water conservation program. He emphasized that the State competing with other States, for new or migrating industries, needs a water use policy that will conserve and develop our water resources. Industry already realizes that a program of redemption is inevitable in all States where pollution has occurred.

Industrial Wastes Are Resources

Mr. Thomas J. Powers of the Dow Chemical Company led off the second day of the meeting with a discussion of "Industrial Wastes as Water Resources."

WATER RESOURCES SESSION—Scott B. Berkeley, speaking Robert E. Stiemke, moderator; Messrs. O. J. Miller, F. C. Toal, and R. G. Waitt, speakers.

TEXTILE WASTES SESSIONS—Nelson L. Nemerow, moderator; seated, left to right are speakers J. C. King, C. F. Gurnham, and B. W. Dickerson.

To make economic use of our water resources, he proposed that we must make use of the assimilative capacity of streams to accept waste without impairing their usefulness. A watercourse is a treatment plant, and has certain natural abilities to remove impurities. The capacity of this natural plant is governed by the character of the stream, however, and every stream is different.

So-called "effluent standards" do not recognize the varying ability of receiving waters to assimilate pollution. Examples were given by Mr. Powers to show how arbitrary effluent standards for wastes are unduly restrictive, and how they require an unnecessarily great investment if they are to be met. Small changes in water quality may affect the usefulness of the water, and the importance of assessing the significance of these changes was emphasized. Practical methods of investigation, including the bio-assay, were described. He pointed out that increasing knowledge and its application will inevitably result in converting industrial waste waters to water resources.

Specific Wastes Discussed

Three simultaneous sessions were offered on the topics of textile wastes, pulp and paper wastes, and municipalities and general manufacturing.

Textile Session

C. Fred Gurnham, Head of Chemical Engineering at Michigan State College, presented a paper on "Textile Waste Abatement Policies and Practices."

Managements are concerned with pollution somewhat selfishly, he stated, because of the increasing demands of their own and other industries for large quantities of clean process water. More important than this and other "pressure" actions, is managements' view of promoting good public relations and community welfare. There are three general steps in the abatement of pollution: (1) waste elimination or reduction in the manufacturing process; (2) waste treatment; and (3) utilization of the assimilative capacity of the rivers as a means of treatment. Dr. Gurnham pointed out the value of cooperative research in finding new and economical means of treatment. He discussed the three general types of treatment: chemical, physical, and biological as they apply to textile wastes.

Flue Gas Utilization

Mr. J. C. King, Research Director of Fairforest Bleachery, Spartanburg, South Carolina, discussed "A Solution to the Highly Alkaline Textile Dye Wastes Problem." To make use of by-product flue gas, a mill must:

(1) Have a plentiful supply of CO_2—at least 50 per cent more than empirically required.

(2) Take into account the numerous gaseous impurities present.

(3) Utilize a properly engineered system to take care of gas dispersion, settling of solids, sludge removal and automatic controls.

Dr. King pointed out that the Fairforest Bleachery is installing the first full scale plant utilizing boiler flue gas to reduce excess alkalinity to permissible levels in the effluent. Gas is to be withdrawn from a stack breeching to a scrubber, where fly ash and other impurities will be removed and the gas temperature will be reduced. The gas then will pass through a centrifugal blower and into a concrete carbonation chamber of about 15-minutes retention capacity. After carbonation, the waste will be discharged into a settling basin having sludge collection mechanism, and held for a 30-min. retention period. The sludge, after conditioning on sand beds, is to be sold as a soil conditioner. The carbonated waste water is further retained in a lagoon for one day before passing down a cascading aeration channel into the river.

Cotton Desizing Waste Problem

Mr. B. W. Dickerson, Sanitary Engineer of the Hercules Powder Company, spoke on "A Solution to the Cotton Sizing Problem — Soluble Sizes".

From a breakdown of pollution sources in a finishing mill, it is evident that the major contributor (50-60 per cent) is the desize load. Mr. Dickerson reported on experimental results comparing 0.1 per cent solutions of starch and carboxymethyl cellulose as sizes for cotton goods. His data were most enlightening since they indicated that CMC apparently had a very low BOD value and, should it be used alone, might provide a reduction of 98 per cent in the organic load produced by the desize operation. Bacterial studies eliminated toxicity as a factor from further consideration.

Actual practice and the economics of the operation have shown that

about 65 per cent starch and 35 per cent CMC to be normally applicable. In general, it has been found that the use of the 65-35 mixture, in place of starch alone, will increase slashing costs by as much as 15 to 20 per cent and give a 38 per cent reduction in BOD.

Pulp and Paper Session

Mr. T. L. Moore, Consulting Sanitary Engineer of New York City, spoke on "Activated Sludge Waste Treatment".

He outlined a step program, together with presenting a description of a constructed plant, in an effort to show an orderly method for the solution of waste problems. Kraft waste has been treated by the activated sludge process; considerable testing and planning is required for the selection of aeration equipment. Although results are promising, three problems require further investigation: color removal, foaming, and sludge disposal.

Mr. Fred V. Doutt, Chief Chemist of the Champion Fibre and Paper Company, delivered a talk titled: "Unused Water is no Waste Problem".

The basic cause of waste load is the desire of all people for higher quality of living, longer life by reason of more safeguards of health, and a desire to create and maintain a desirable environment for present and future living. The second cause is the fact that the water supply is static while the population and its demand for water are rapidly increasing.

Water is used in the pulp and paper industry in four ways: for cooling, transportation, energy and solvent purposes. Mr. Doutt advocated the study of the water requirements for each of these uses. He reported laboratory trials in which water was recycled six times, in an effort to determine the effect on the pulp. This project is still in the study stage, but results indicate that bleached pulp may be well washed with recycled water. Mr. Doutt closed with the statement that "the water you save will save you".

Dr. Harry W. Gehm, Technical Advisor, National Council for Stream Improvement of the Pulp and Paper Industries, spoke on "Progress of the Pulp and Paper Industry in Effluent Treatment".

Municipal and Manufacturing Session

This session was presided over by Clarence E. Keefer, Deputy Sewerage Engineer of Baltimore, Maryland.

Programmers

J. W. Williams
Chairman

R. E. Stiemke
Moderator

Daniel A. Okun
Presiding

J. M. Kniskern
Pulp and Paper

C. E. Keefer
Municipalities

Paul D. Haney
Economics

Mr. H. B. Snyder, Jr., Sales Engineer of Wallace and Tiernan Company, presented the "Problems of Metal Finishing Wastes in Municipal Treatment".

Metal finishing wastes may contain cyanides, copper, zinc, cadmium, hexavalent and trivalent chromium, nickel, cobalt, tin, silver, gold, alkalies, acids, oils, detergents and many other substances. The various possible combinations of these substances are tremendous, but in general the wastes may be separated at the source into two collecting systems: alkali rinses, including cyanides; and acid rinses, including chromium and nickel.

Alkali wastes can be treated with chlorine and caustic to oxidize the cyanides to cyanates—and even to carbon dioxide, nitrogen, and nitrous oxides. Heavy metals tend to precipitate out of solution during the process.

Acid wastes can be treated with sulfur dioxide or ferrous sulfate and alkali. The bulk of the metals are precipitated and removed as a sludge. It often is economical to reclaim chromium from some wastes by use of ion exchange resins, thus recovering a valuable by-product as well as removing the toxic material.

Domestic wastes in general are treated by sedimentation and biological means to render them harmless, thus they present no great difficulty. When metal finishing wastes are mixed with sanitary wastes, however, the cyanides and metals have toxic effects on the biological flora and fauna of the normal treatment process. Various investigators have studied the toxic effect of these wastes on fish as well as on the biological organisms in the treatment processes. They have found various orders of toxicity of metals depending on pH, strength of sewage, time, types of treatment and other factors.

Pretreatment of the metal finishing wastes is, in general, the most satisfactory answer to the problem. Removal of the metal waste constituents is usually not feasible once these wastes are mixed with domestic sewage.

Waste Surveys and Surcharges

Mr. Arthur B. Caster, Principal Engineer of Sewage Disposal Section of the City of Cincinnati, described "Industrial Waste Surveys for Municipalities".

The Cincinnati Industrial Waste Ordinance provides a sewer surcharge for wastes of strength greater than that of "normal sewage", which is designated as having 240 ppm of BOD and 300 ppm of suspended solids. The surcharge is designed to provide funds to amortize the cost of the additional facilities necessary to treat wastes of greater than normal strength. The surcharge, based on BOD, suspended solids, and volume of flow, is equivalent to 1.29 cents per pound of BOD, and 1.05 cents per pound of suspended solids, above that of normal sewage.

Information on specific industrial wastes is obtained by questionnaire, field investigation, the use of sewer tap records, and sampling and gaging operations. Mr. Caster's report is of wide interest, and will shortly be published as an article in *Water & Sewage Works*.

MUNICIPAL and MANUFACTURING—Speakers (left to right) A. B. Caster, H. B. Snyder, Clarence E. Keefer (Session Moderator), and Julian Fleming.

Ordinances Controlling Industrial Wastes

Mr. Julian Fleming, Director of Sanitary Engineering of the Tennessee Department of Health, presented a paper on "Municipal Ordinances for Industrial Wastes".

The ordinances pertaining to industrial waste in the City of Knoxville were passed by the City Council in 1954 and 1955. Sewer service charges are made as a percentage of the metered water bill, except for those industries that do not send all the water to the sanitary sewer. In such cases secondary meters are used to determine the volume contributed to the sewer. Billing and collections are handled by the Knoxville Utility Board, along with gas, electric and water charges.

A rate beyond the regular charge may be assessed against an industrial user if the BOD, suspended solids, chlorine demand, or other properties of the waste are such that abnormal expense is incurred in the treatment of the waste. At present no surcharge is made on any industry. Each industry is required to file certain information relative to its waste with the city, within 18 months from the time of passage of the ordinance. If it is adjudged necessary that an industry's waste be pretreated, a fixed time period is allowed for submitting plans and awarding contracts for construction of pretreatment facilities.

Certain substances, such as hot liquids (above 150°F.), greases, gasoline, rapidly settleable solids, corrosive liquids, toxic substances, cyanides, and radioisotopes are excluded from the sewer. Highly colored water, slugs of very strong liquid wastes, and certain specific types of wastes are considered individually and may be required to be pretreated before being admitted to the sewer.

The solution of problems that arise in this matter can usually be found by cooperation between the city and industry. Of the problems that have already arisen in such industries as soft drink bottling, plating, and meat packing, reasonable solutions have been obtained that were satisfactory both to industry and the city. It is expected that new problems will arise but it is believed that cooperative effort will solve them.

Speaker Discusses Fundamental Research

The second luncheon of the conference was addressed by Dr. Paul M. Gross, Vice-President in the Division of Education at Duke University. He spoke on "The Role of Fundamental Research in Industrial Development."

The nation as a whole, he stated, and the South in particular, must develop "a sound program of education and fundamental research to accompany startling industrial growth." Industrial development is not sound unless it is accompanied by the fundamentals for a well-balanced economy.

As an example of industrial growth, Dr. Gross, a noted chemist, cited a shift of the nation's center of chemical manufacturing to the South within the last five or six years. Our expanding economy is highly technological, and we need manpower resources. Therefore, we must insure a parallel development of the educated supply of men and fundamental research, out of which applied research will come. The South's industrial growth will not be sound unless Southern-trained men and women are employed in supervisory technical and managerial positions. The men that are needed at these levels are men of vision, high competence and ability.

Fundamental research, viewed in long-range, will determine the fate of industries. For example, knowledge of atomic and nuclear energy will have a profound effect on all types of industries. Dr. Gross also stressed the importance of the exchange of ideas. The iron-curtain is a two-way thing, he said, pointing out that the fundamental theory of atomic energy was a world-wide development. The history of our continual growth has been a process of the transmission of fundamental ideas, with more and more minds to think about ways and means for application of new discoveries, devices and techniques.

Panel on Engineering Aspects

A panel discussion on the "Engineering Aspects of Pollution Control" was presided over by Paul D. Haney, Consulting Engineer of Kansas City.

Mr. Malcolm Pirnie, Jr., and Richard Pope, consulting engineers, presented a paper on "Designing for Flexible Plant Operation."

An example was cited in which design of a textile waste treatment plant for flexible operation would have prevented a large fish kill with its attendant bad publicity for the plant. All that would have been required was a holding lagoon to permit storage during short periods of extremely low stream flow. Four requirements for providing flexibility in a waste treatment plant were given and illustrated with examples:

1. Space should be reserved for future supplemental treatment.
2. Any supplemental features provided should be low in capital cost in comparison to normal treatment facilities.
3. Standby charges for these features should be low.
4. No breaking-in period should be required.

A fifth important requirement is that the plant operate properly.

Flexibility in Plant Operation

Mr. Richard H. Gould, consulting engineer, discussed the part that "Flexible Plant Operation" plays in pollution control.

The degree and kind of treatment for pollution control can be flexible, he noted, as the capacity of a stream to assimilate pollution varies greatly between periods of hot weather with low flows, and colder weather with flood flows. Failure to recognize this can be expensive. The principal methods of waste treatment were described and examples were given to show how flexibility in utilization of these methods can provide the degree of treatment necessary to meet the varying stream conditions. This results in substantial economies in construction and operation of waste treatment facilities.

Flexibility can also provide adjustments to compensate for inadequate

capacity without resulting in a complete breakdown of the treatment. There is a need for better understanding among municipal and industrial officials of the importance of sound and imaginative engineering in the development and operation of waste treatment works.

Economic Considerations Emphasized

Mr. Paul Haney then discussed the "Economic Considerations." The words "economics" and "engineering" are almost synonymous.

As applied to the use of streams, he reviewed H. G. Baity's conclusions that:

1. A stream must be recognized as supplying various important needs within the drainage basin, and that all these uses must be considered and balanced.

2. One of the natural and inescapable uses of streams is to receive the waterborne municipal and industrial wastes of man.

3. The self-purification capacities of streams must be utilized to a greater or less degree in all cases, alone or as an adjunct to treatment processes, and complete treatment of all wastes is neither economically possible nor scientifically necessary.

The determination of the assimilative capacity of streams, according to Mr. Haney, requires extensive field, laboratory and office studies. Nevertheless its determination is necessary if economical and equitable assignment of treatment requirements is to be made. Allocation of available assimilative capacity among many users is a complicated problem, even when that capacity is known, and requires much clarification. With increasing need for water, it appears likely that waste water soon will be recognized as a water resource.

B. W. Dickerson
Cotton Washes

Wade G. Brown
Presiding

R. H. Gould
Flexible Plants

T. J. Powers
Resources

H. B. Snyder
Metal Wastes

Malcolm Pirnie, Jr.
Design

Plans for Fifth Conference

The Fifth Southern Municipal and Industrial Waste Conference will be held in March, 1956, at Chapel Hill, North Carolina, at the University of North Carolina.

Award to Governor Williams Recognizes State as "Water Wonderland"

PRESENTATION—Left to right are Ervin Stahl, District Manager, Layne-Northern Co.; Edward J. Rogers, President, Layne-Northwest Co.; Governor Williams; J. I. Seay, President and Chairman of the Board, Layne & Bowler, Inc.; and A. O. Putnam, Director of Public Relations.

At a ceremony recently held in the offices of Governor G. Mennen Williams in Lansing, Michigan, the 1955 Layne Award was presented to the Governor by Mr. J. I. Seay, President and Chairman of the Board of Layne & Bowler, Inc., of Memphis, Tennessee, assisted by Mr. Edward J. Rogers, President of the Layne-Northwest Company.

The award was made in recognition of the State's promotion of Michigan as "Water Wonderland."

In making the presentation, Mr. Seay said that it was fitting that a man from the banks of the Father of Waters, old man river himself, the mighty Mississippi, should salute the chief executive of a state that justly deserved the title of "Water Wonderland."

In reply the Governor said in part that he was certain that the promotion of Michigan as the nation's "Water Wonderland" would result in stimulation of a great and growing number of vacations and tourists and that the nation's recognition of the state as a summer playground would benefit all of the people of the state.

Federal Sanitary Engineers Form an Organization

The Conference of Federal Sanitary Engineers has recently been formed to serve as a means of bringing together engineers engaged in the practice of Sanitary Engineering (including Industrial Hygiene) in the Federal Government, in a manner similar to the Conference of State Sanitary Engineers, and the Conference of Municipal Public Health Engineers.

Membership in the Conference is open to any sanitary engineer (as defined by the National Research Council) who is on active duty as a commissioned officer of the Army, Air Force, Navy, or USPHS; or who is a civilian employee of any department or agency of the U. S. Government.

Maintaining Sewage Metering Devices

A review of simple but essential practices which apply to inferential and gravity flow types of meters

by F. L. SOMMER

Mr. Sommer, of the Simplex Valve and Meter Co., Philadelphia, Pa., in this article points out the importance of uninterrupted metering in many sewage treatment applications. By applying his specific recommendations for routine inspection, checking, and repair, the plant operator can be assured of dependable meter service.

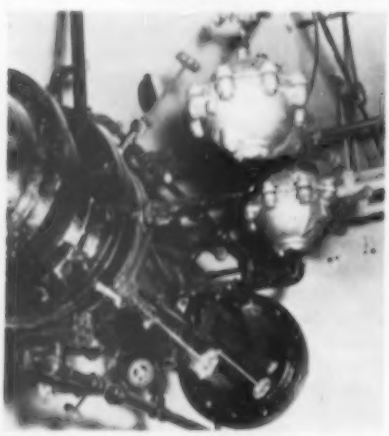
THE STRIDES made in recent years in sewage treatment practices have increased the importance of measuring devices, and the sewage meter is now considered essential to proper operation. Thus it follows that an understanding of the meters and their maintenance is also essential.

Meters are used in critical places within the plant for the measurement of raw sewage, clarified sewage, sludge, and air flow. They may be considered desirable, depending upon the installation, for measuring the inflow to the plant, the out-fall from the plant, or measuring flows at various points within the plant. They also may have a definite use in the proportioning of liquids.

Sewage metering devices can be arranged in two broad general classifications, each of which has its own maintenance problems. The first classification includes the types of meters suitable for use where the liquid or gas is flowing through pipes under positive pressure. The second category includes those meters which are used for measurement of flow through open sewers, or of flow through pipes running partially full.

Inferential Types of Meters

Where liquids must be measured under pressure, the general form of meter used to determine the flow is the inferential type of meter. This is an instrument utilizing a differential pressure-producing device in the line, such as a Venturi tube.



VENTURI meter with cleaning valves designed to serve as reamers

Sewage Venturi tubes usually are provided with a pressure belt at both the main and throat diameters, each belt being equipped with cleaning valves. These are spaced at equal intervals around the circumference of the belt, and are designed to serve as reamers when directed from their retracted position down through the piezometer openings leading from the interior of the tube to the respective pressure chambers. Normally these valves are hand-operated, and it should be the practice of the operator to clean out foreign matter from the piezometers by means of these cleaning valves, approximately one a day. Flushing of the belts should be carried out with a clear water supply.

In order to insure to the greatest possible degree that little or no sediment enters the mercury cylinder of the secondary meter, sediment tanks are installed at some point in the pressure lines connecting the Venturi tube to the instrument cylinder.

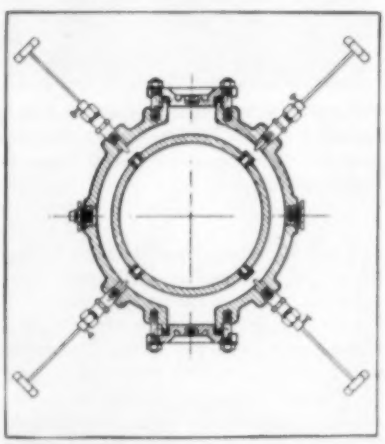
On the upper end of a sediment tank there is attached a flushing device seat, while at the lower end there is a drain cock. The pressure line from the Venturi enters the side of the tank at about one-third the entire length from the bottom, and the outlet to the meter is taken at about the same distance from the top. Thus, any sediment which does find its way into the pressure tank may settle to the bottom and to collect there, rather than proceeding along the remaining length of piping to the meter cylinder,

Water for Flushing Sediment

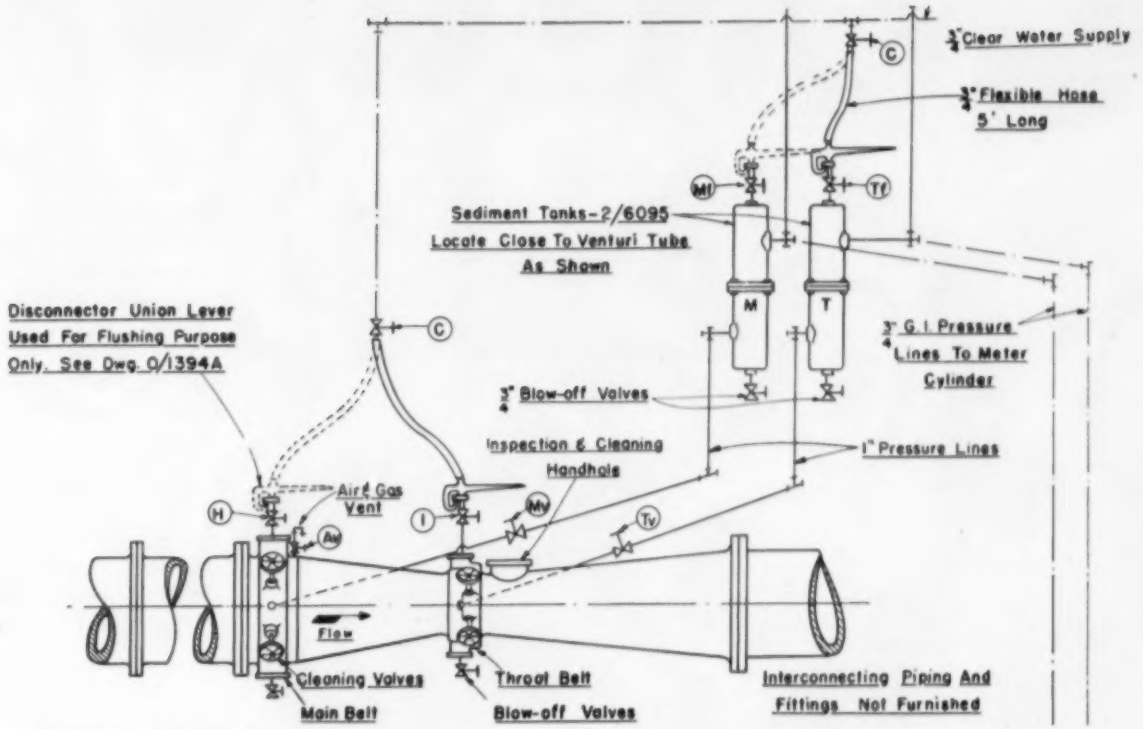
The purpose of the flushing valve seat at the top of the tank is to provide a temporary connection for a clear water flushing supply, so that at frequent intervals the sediment tank may be flushed clean. The tanks usually are placed close enough to the Venturi tube to utilize the same source of water supply as is used for flushing the pressure chambers of the tube.

In those plants having a pressure supply of water not used for drinking purposes, a continuous backpurge of the pressure lines is possible. The liquid generally used is sewage effluent, and normally a pair of special check valves is placed in the purge lines to prevent entrance of occasional solids which may be carried over from the treatment process. Also installed in the pressure lines are small flow indicator regulators, to provide a means of controlling the flow equally to each pressure belt.

Use of the continuous backpurge system does not eliminate entirely the need for maintenance, but does tend to minimize it. Reaming of the piezometer openings is still required occasionally, and the check valves



SECTION through Venturi tube main diameter—at bottom of Fig. 1.


¾" Clear Water Supply
¾" Flexible Hose 5' Long
Sediment Tanks-2/6095
Locate Close To Venturi Tube As Shown
Disconnector Union Lever Used For Flushing Purpose Only. See Dwg. 0/1394A
¾" G.I Pressure Lines To Meter Cylinder
¾" Blow-off Valves
Inspection & Cleaning Handhole
1" Pressure Lines
Air & Gas Vent
Flow
Cleaning Valves
Main Belt
Throat Belt
Blow-off Valves
Interconnecting Piping And Fittings Not Furnished

PIPING CONNECTIONS for a Venturi meter measuring sewage flow. Note the sediment tanks discussed in text.

should be cleaned if the small flow indicators show a stoppage of the water purge.

A better source of water for back-purge purposes is a system similar to that used for pump priming. In this case, clear water is used from a constant head tank fed from a float valve-controlled clear water line. The tank can be located either at a sufficient height to provide a pressure greater than that existing in the line, or a small pump can be used at the outlet to create the pressure required for purging.

All the foregoing deals with the necessity for and the means of keeping the Venturi tube connections clear. This point cannot be stressed too highly. Sewage flow is not easy to measure, and more than half the problem exists in the tendency toward clogging of the lines with solids. If cleaning is performed regularly, many difficulties can be avoided completely.

Periodic Inspection Is Required

In addition, periodic inspection of the meter itself is necessary. No instrument will remain in correct adjustment indefinitely. Every-day handling, such as changing charts, pens, and other routine adjustments, as well as routine meter operation, eventually result in the need for rechecking. Therefore, the establishment of a regular inspection procedure is definitely recommended. The interval may be six months to a year.

Unusual occurrences such as complete shut-down, long idle periods, or more particularly, complete drainage of the system, require special attention. After such occurrences, the meter should be thoroughly checked and adjusted.

Recommended Checking Procedures For Inferential Meters

A recommended procedure for checking meters includes correction or elimination of conditions such as the following:

Sediment in Meter Cylinder

Remove the cylinder head and the float. The entire contents of the cylinder, including mercury, may be removed by opening the mercury drain plug. Flush the cylinder thoroughly with clear water until the sediment is cleaned out. Weigh the mercury and replace the correct amount as specified by the manufacturer.

Leaks in Pressure Lines

In many installations the pressure lines are buried, and unseen leaks may develop. Tests can be made, however, by the following method: With the meter operating at a specific rate, close the throat valve at the Venturi tube. If the meter pointer remains stationary, there is no leakage in the throat pressure line.

If the pointer moves to a higher value, the line leaks. Close the equalizing valve to stop further rise, and repair the throat pressure line. If the pointer drops backward towards zero, it indicates leakage probably through the equalizing valve.

The same test is then applied to the main connection after the throat valve has been re-opened. In this case, however, if the pointer moves toward zero, the main piping leaks, and should be repaired or replaced.

Obstructions in Pressure Lines

Flush the pressure lines to remove sediment. It may be necessary to replace them if in an extreme case of the blockage cannot be flushed out.

Air Trapped in Cylinder

In normal operation, air will never accumulate under the float but, after emptying of the line or pressure piping, absence of air may be assured by the following procedure:

Close the valves at the main and throat connections to the meter, and open the equalizing valve. This allows the mercury float to lower to zero. On

meters using a square root-extracting float, remove the zero stop cover to reveal the float air vent screw, and release any air accumulation below the float. Air in the cylinder above the float is released by other vents in the cylinder cover.

Air Trapped in Pressure Lines

Vent air at all blow-off points, but do this cautiously to avoid an unexpected shower. The lines, of course, should be properly graded so that no air pockets exist which will interfere with free waterway through the pipes.

Related Maintenance

In addition to the previously described conditions which will cause meter inoperation, four other points need occasional checking.

The Packing Gland

The stuffing box, as packed by the factory, should not leak under normal operating pressure. If leaking does occur, the stuffing box nut may be tightened, *but not too much so,* since excessive friction and lag will result.

To add packing, shut off the main and throat valves and release the operating pressure. Remove the knurled packing nut and pull the brass bushing from the gland. Add the packing and replace bushing and packing gland. When the packing becomes hardened after long usage, it should be completely replaced, using the special packing furnished by the manufacturer.

Oiling

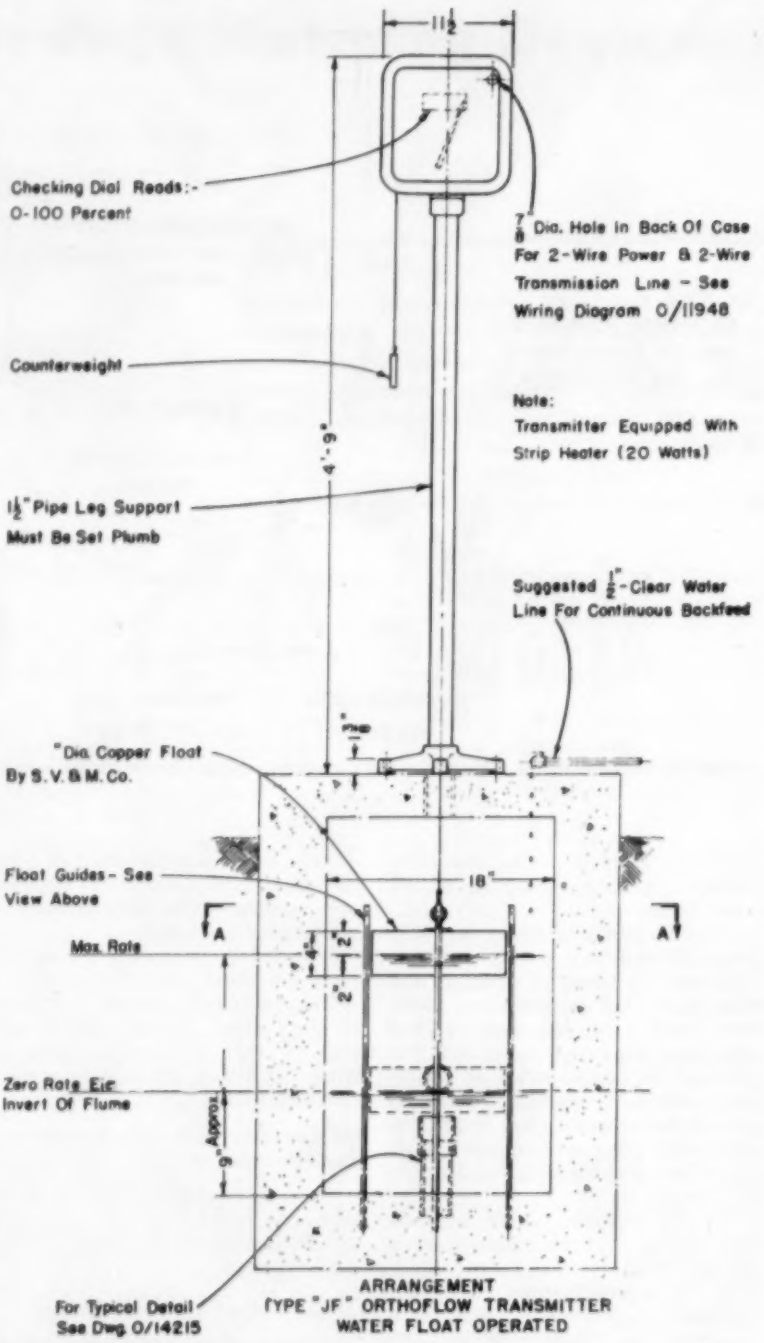
Chart clocks and totalizer drive gears may be oiled lightly from time to time, but avoid oiling other totalizer mechanisms. They may collect dirt, which will interfere with correct operation.

Calibration

The accuracy of the meter depends upon the dial pointer and totalizer adjustment. Most meters are furnished equipped with a water manometer test outfit for setting and checking purposes. The manufacturer's instructions should be followed in carrying out the checking procedure with a manometer.

Chart Pens

Keep chart pens clean to insure a free flow of ink. Use the ink and charts recommended by the manufacturer, to insure that charts provide neat and valuable permanent records.



DETAILS of stilling chamber and float-operated transmitting device.

Gravity Flow Meters

The second classification of meters includes the single head meters which measure gravity flows. Many primary devices are used, such as flumes and weirs of various forms. All these devices depend upon a standard head-quantity relationship, so that at any measured head or level, the flow can readily be determined by reference to a table or curve of graphic form.

In order to maintain continuous metering, a cam is carefully machined, with the head quantity curve embodied in it. For any given rise of a float responsive to the primary level, the meter mechanism is moved by the cam an amount equivalent to the flow value.

The cam may be located within a transmitter if the primary device is

remotely located from the registering point, or may be in the register itself when the float well is directly below the meter.

Recommended Checking Procedures For Gravity Flow Meters

From the standpoint of maintenance, the greatest potential difficulty in operating gravity flow meters is the single transmission pipe from the primary device to the float well. It must be kept clear of solids so that head changes can ge reflected quickly by the float.

A constant dribble of clear water into the float well is the best means of preventing clogging of the line. Keeping the float well filled with clean water (to the level in the primary device) creates a very slight backflow toward the weir or flume. This, of course, tends to keep the fluid being measured out of the piping and the well. It is still necessary, however, to flush the connections occasionally with a pressure purge.

To facilitate cleaning, all changes in the piping should be fitted with plugged tees rather than elbows, to allow rodding if the water purge alone does not suffice for cleaning purposes.

In addition to the piping, the float and float well also must be clean and free from solids which would interfere with free movement of the float. A blow-off point should be provided at the bottom of the well to facilitate cleaning at this location.

It is not always possible to provide the clean water dribble into the float well; in these cases, special attention must be given. Frequent cleaning is generally required, unless the fluid being measured is clear final effluent. A manual type force pump often is used for purging of this type.

Minor Adjustments of Meters

Finally, in addition to keeping a free flow of liquid between the primary and the float well, the metering instrument must be kept in calibration by following the manufacturer's recommended procedure. The recording pen must be kept clean to insure free flow of ink, and certain parts must be oiled.

Most standard meters are so simple in construction that any operator should readily be able to assimilate its details and operating characteristics, and to make minor adjustments by reference to the instruction booklets provided.

When testing or repairs of a more complicated apparatus are needed, consult the manufacturer's field engineers. Unquestionably, this is proper practice with regard to equipment such as proportionate controls, summation units, and the various forms of electrical transmission.

With standard equipment, however, it is possible for the operator to make his own adjustments and simple repairs without outside assistance. If each operator will familiarize himself with the salient points of his metering equipment, he can learn to make minor adjustments easily, and thus can save many hours or days that would be required in waiting for field engineers to reach the plant.

Service engineers always are happy to supply information and to give the benefit of their experience and knowledge. By close contact with the serviceman on the job, the operator can learn not only the principles involved in the construction of metering equipment, but the short-cuts of technique in repairing and adjusting it. This information makes possible more efficient meter operation. An example of knowledge which can be gained by working with a service engineer installing or repairing the equipment, is that of the points in each type of metering apparatus which require special attention.

Conclusion

The condition of plant equipment is a good index of plant efficiency. There is no reason why any essential equipment should be allowed to remain idle or in poor operating condition. Though there may be extreme cases where this is temporarily necessary, the slight extra expenditure of time and money required cannot balance the loss of efficiency and of vital operating records that result from faulty meter operation.

It is the purpose of this discussion to bring to the sewage treatment plant operator's attention a few of the remedies applied by manufacturers' service engineers. Although the need for these representatives will, no doubt, never be eliminated, it is believed that plant operators can adopt many of their techniques, and can improve maintenance programs on their own initiative. Operators who do so thus place themselves in a better poistion to provide uninterrupted operation of a sewage treatment plant.

W&SW

British Water Pollution Research 1954 Report Is Published

The annual report of the Water Pollution Research Board and of the Director of Research, for the year 1954, includes an account of the new laboratory in Stevenage, which was occupied during the year. Progress made in the survey of the Thames estuary and in investigations on the effect of pollution on fish is described and also work on the treatment of water, sewage, and industrial waste waters.

This well-prepared and illustrated summary of research studies covers problems of equal interest in the United States: synthetic detergents, biological treatment of cyanides, removal of fluorides, automatic recording of dissolved oxygen, and many others.

Copies of the 66-page report at $.75 from British Information Services, 30 Rockefeller Plaza, New York 20, N. Y.

"How to Boil Water" Is Booklet of Practical Value

How to use water correctly in numerous household tasks and how to keep water-using appliances and home heating and plumbing equipment in good working order is described in an easy-to-read booklet, "Do You Know How to Boil Water?", recently issued by the Jamaica Water Supply Company, Jamaica, N. Y. This is an exceptionally fine contribution to good public relations: one which other public and private utilities might well emulate.

Humorously illustrated with such characters as "The Puzzled Bather," "The Friendly Wrench" and "That Drip—The Faucet," the booklet gives practical advice on soap vs. detergents, best water temperature for laundering, how long to brew tea, distilled vs. tap water for the electric steam iron, the most efficient way to fix leaky taps and similar important household tasks.

Daniel J. Hennessy, president of the Jamaica Water Supply Company, states that the booklet is being distributed as a service to the company's 110,000 customers in the Queens-Nassau area on Long Island. It provides answers, based on the company's 68 years experience in the water business, to the questions most commonly used by consumers. The text of the booklet has been reviewed by the Good Housekeeping Bureau, which rated it "an excellent job—of great help to many consumers of water."

Giants are where you find them. In a paper titled "There Were Giants in Those Days," C.-E. A. Winslow has recalled the contributions of certain pioneers in the public health field during the decades between 1890 and 1910. His paper was presented in a symposium on a "Century of Progress Through Sanitation" at the Eightieth Annual Meeting of the APHA. The water works field has had its giants, too, but–

There Are No Giants Any More

EDITORIAL by Harry A. Faber

1955 MARKS THE BEGINNING of the seventy-fifth year in the history of the American Water Works Association. It was a pioneering age, when the first meeting of the association was held in 1881. To the twenty-four original members, water supply, water conditioning, and water distribution were not simple problems. There were distinguished technical men among early workers in our field, men who laid well the foundations in chemistry, engineering, and bacteriology upon which we have continued to build. These men were giants indeed.

As the years passed, we have made much progress; but always progress has merely expanded our horizons. A summary review reveals that we have done little more than keep pace with the same, but magnified, problems of water supply, conditioning, and distribution.

THE MOST ASTONISHING change in water works practices during the last fifty years is the increasing *rate* of change. In many parts of the United States, we are now approaching the end to plentiful supplies of potable water. Similarly, in certain industrialized areas of this country the waste-assimilating capacity of streams has already been exceeded.

Serious consideration must be given immediately to the proper use of our most essential resource. The water needs and problems of today could not have been anticipated seventy-five years ago, but we certainly can foresee some needs which will arise during the next twenty years.

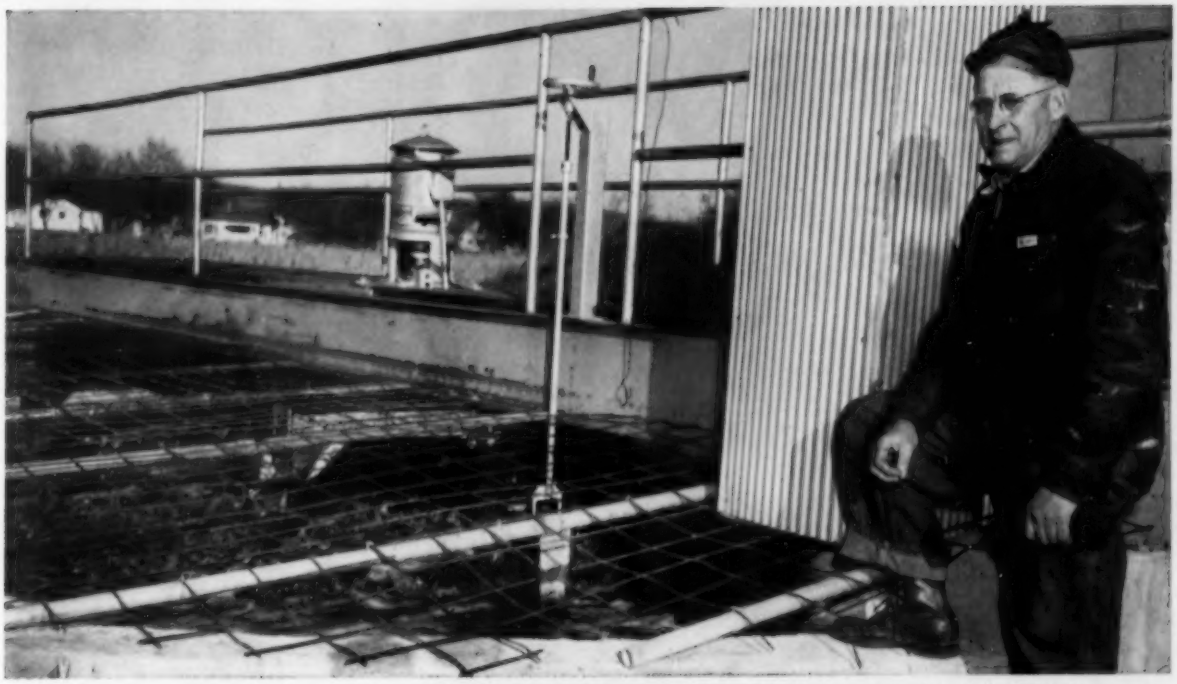
We can be sure that our water volume requirements will increase. Present estimates are for a population of over 200 million, and a doubled industrial production, by the year 1975. We can be equally certain that our water conditioning needs will become more complicated, for surely the type and concentration of water pollutants will increase.

BUT THE DAY of giants has passed; giants were created by nature to meet a special need at a specific period of time. We may remember our giants and their accomplishments somewhat wistfully, but let us face the fact that our problems are now beyond the ability of one man—or even a few men—to solve. The coordinated skills of many diverse technical specialists are needed to meet our present and future problems of water supply. Our background in public health engineering must continuously evolve with developments in all related sciences.

The American Water Works Association recognizes the need for specialization: It has four divisions of membership—management, resources, purification, and distribution. The association competently plans and directs the preparation of standards, specifications, and manuals.

WHAT MORE must we and our association undertake? Two needs are immediately evident: There must be greater emphasis in all fields of research affecting water supply, and basic planning to secure adequate technical personnel for the operation of our utilities. We are in competition for the services of those trained in engineering, management, and research. Steps should be taken to insure a supply of competent young technicians in the water works field.

There are no giants any more—we now need specialists to fulfill our responsibilities in public health.



Mr. J. M. Bricker received the award at a recent meeting of the Nebraska Sewage and Industrial Wastes Association. Among other duties for the town of Paxton, Mr. Bricker spends about 12 hours per week looking after the 'Pakage' plant.

SCOTT-WILBUR

Award

"Sewage Plant Operator Having The Best Maintained And Operated Sewage Treatment Plant in Nebraska During 1954"

CHICAGO PUMP COMPANY'S

Activated Sludge 'Pakage'* Plant Performance Helps Win Coveted Award

Award Winning Sewage Treatment Plant, Paxton, Nebraska. Installation contains one 14' combination Aerator-Clarifier unit. Plant capacity: 75,000 G.P.D., treating domestic sewage. Consulting Engineer: Ogallala Engineering Company. Constructed by Beal Construction Company.

Activated sludge 'Pakage' sewage treatment plants are specifically designed for small communities such as Paxton, Nebraska. They are not large plants scaled down.

The automatic features of the 14' aerator and clarifier in the 'Pakage' plant at Paxton assure trouble-free performance while treating 75,000 G.P.D. of domestic sewage. 'Pakage' plants handle sewage flows from 15,000 to 500,000 G.P.D. in single or multiple units. The plant at Paxton is located near dwellings, like so many other Chicago 'Pakage' Plants, since they are clean, sanitary, and have no objectionable odors. Visitors are amazed at the crystal-clear effluent. In the past 21 years, Chicago 'Pakage' Plants have given trouble-free sewage treatment in over 230 installations.

For small communities, industrial plants and institutions, specify Chicago 'Pakage' Plants. Write Dept. K for complete engineering data and drawings.

* A trade mark of Chicago Pump Co.

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Here's a booklet that presents startling facts about variable speeds. It tells how to apply U. S. Varidrive motors to your equipment, ways to get more productive manhours, methods of improving quality of workmanship, more efficient plant operations, and lists savings you can make in power and payroll. This valuable engineering booklet is profusely illustrated in striking colors. It details latest improvements and shows how you can have speeds from 2 to 10,000 rpm at your command. Illustrates 28 Varidrive models. ¼ to 50 h.p. Request this amazing 16-page booklet for latest data on variable speeds.

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W&SW

Meetings Scheduled

June 12-17—Chicago, Ill.
AMERICAN WATER WORKS ASSOCIATION. (75th Annual Convention). Exec.-Sec'y, Harry E. Jordan, 521 Fifth Avenue, New York 17, N. Y. (All reservations being cleared through A.W.W.A. office.)

June 13-14—Albany, N. Y. *(Hotel Ten Eyck)*
NEW YORK SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, R. C. Sweeney, 21 No. Broadway, White Plains, N. Y.
(joint meeting with)

June 13-14—Albany, N. Y. *(Hotel Ten Eyck)*
NEW ENGLAND SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Stephen M. Hurley, Jr., 331 State Office Bldg., Providence, R. I.

June 16—York Harbor, Maine, *(Marshall House)*
NEW ENGLAND WATER WORKS ASSOCIATION. Sec'y Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

June 17—Berkeley, Calif. *(Univ. of Calif.)*
NORTHERN CALIFORNIA SECTION of the AMERICAN INSTITUTE OF CHEMICAL ENGINEERS (For Further Information Contact E. G. Foster, Shell Development Co., Emeryville 8, Calif.).

June 22-24—Rochester, Minn. *(Kohler Hotel)*
CENTRAL STATES SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Geo. F. Bernauer, 713 Chapman St., Madison, Wis.

June 22-24—Columbus, O. *(Deshler-Hilton Hotel)*
OHIO SEWAGE & INDUSTRIAL WASTES TREATMENT CONFERENCE. Sec'y. Ward E. Conrad, 301 Ohio Departments Building, Columbus, O.

Aug. 15—Richmond, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Aug. 15-19—Blacksburg, Va., *(Virginia Polytechnic Institute)*
WATER & SEWAGE OPERATORS SHORT SCHOOL, Prof. J. D. Eye, V. P. I., Blacksburg, Va.

Aug. 22-24—State College, Pa. *(College Dormitories)*
PENNSYLVANIA WATER WORKS OPERATORS ASSOCIATION. Sec'y, R. Rupert Kountz, Penn. State University, State College, Pa.
(joint meeting with)

Aug. 22-24—State College, Pa. *(College Dormitories)*
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, B. B. Bush, State Dept. of Health, Kirby Health Center Wilkes Barre, Pa.

Sept. 7-9—Saranac, N. Y. *(Saranac Inn)*
NEW YORK SECTION A.W.W.A. Sec'y, Kimball Blanchard, 56 Grand St., White Plains, N. Y.

Sept. 7-9—Fort Dodge, Ia. *(Hotel Waukonsa)*
IOWA SEWAGE WORKS ASSOCIATION. Sec'y, L. F. Skorczeski, 207 South 15th Ave., Marshalltown, Ia.

Sept. 12-14—Lexington, Ky. *(Phoenix Hotel)*
KENTUCKY-TENNESSEE INDUSTRIAL WASTES & SEWAGE WORKS ASSOCIATION. Sec'y, S. Leary Jones, 420 Sixth Ave., Nashville, Tenn.

Sept. 12-14—Lexington, Ky. *(Phoenix Hotel)*
KENTUCKY-TENNESSEE SECTION A.W.W.A. Sec'y, J. Wiley Finney, Jr., 553 S. Limestone St., Lexington, Ky.

Sept. 14-16—Flint, Mich. *(Durant Hotel)*
MICHIGAN SECTION A.W.W.A. Sec'y, T. L. Vander Velde, State Dept. of Health, Lansing, Mich.

Sept. 18-22—Lake Placid, N. Y. *(Lake Placid Club)*
NEW ENGLAND WATER WORKS ASSOCIATION. Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

(Continued on page 80A)

Shenango Valley Water Company converts six filters to ALOXITE® underdrains

The Shenango Valley Water Company started operation in 1884 with five miles of mains serving 600 customers and 80 fire hydrants. Today, its 140 miles of mains deliver an average of 7 MGD to 14,000 homes, businesses and institutions in the Sharon-Shenango Valley region of Pennsylvania.

The company's eight filters have a capacity of 8 MGD. Its first ALOXITE aluminum oxide porous underdrain was installed in 1952. Since then, five more filters have been similarly modernized — the sixth set of ALOXITE plates is about to go into service.

This continuing program of filter modernization speaks well for the operating advantages provided by filters built with ALOXITE underdrains: elimination of upset beds . . . complete backwashing . . . freedom from mudballs . . . minimum loss of head.

It is easy to see why the Shenango Valley Water Company has been able to keep so well abreast of the growing water needs of the area it has served so long. The company's management and engineering staff deserve much credit for their progressive policy.

This informative 56-page booklet covers porous media for all fields of filtration and diffusion. Write us for your free copy today.

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**Dept. X65, Refractories Division,
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Aurora Non-Clog Pumps, both Vertical and Horizontal have won high favor

— for industrial by-products, semi-solids, wastes, municipal sewage plants, lift stations, buildings and all duties involving the handling of heavy liquids and liquids containing solids.

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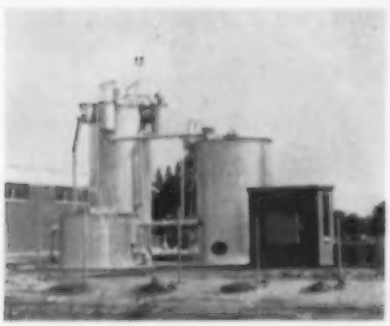
THE NEW YORK AIR BRAKE COMPANY
60 LOUCKS STREET — AURORA • ILLINOIS

AN ALL STEEL
Waste Treatment Plant



The tank at the left is a Spiragester, the tank to the right is a high rate filter, and the short tank in the foreground is a non-mechanized hoppered bottom final Spiraflo Clarifier. The plant handles the wastes from an ice cream manufacturing plant.

Write for New
Spiragester Bulletin No. 135

LAKESIDE ENGINEERING CORPORATION
222 West Adams Street • Chicago 6, Ill.

(Continued from page 78A)

Sept. 19-21—Laramie, Wyo., *(Connor Hotel)*
ROCKY MOUNTAIN SECTION A.W.W.A. Sec'y, J. W. Davis, Johns-Manville Sales, Inc., Denver, Colo.

Sept. 21-23—Atlanta, Ga., *(Hightown Textile Bldg., Georgia Institute of Technology)*
24th ANNUAL GEORGIA WATER & SEWAGE SCHOOL, Secy. Treas., 1210 Hemphill Ave., N. W. Atlanta, Ga.

Sept. 21-23—Columbus, O. *(Neil House)*
OHIO SECTION A.W.W.A. Sec'y, M. E. Druley, Dayton Power & Light Co., Wilmington, O.

Sept. 21-23—Milwaukee, Wis. *(Hotel Schroeder)*
WISCONSIN SECTION A.W.W.A. Sec'y, Leon A. Smith, City Hall, Madison, Wis.

Sept. 21-23—Winnipeg, Manitoba, Canada *(Royal Alexandra Hotel)*
WESTERN CANADA WATER & SEWAGE CONFERENCE. Sec'y, W. J. Waddell, 3610 Manchester Road, Calgary, Alberta.

Sept. 25-27—Joplin, Mo., *(Connor Hotel)*
MISSOURI SECTION A.W.W.A. Sec'y, W. A. Kramer, Rm. 3, 6th Floor State Office Bldg., Jefferson City, Mo.

Oct. 4-5—Springfield, Ill. *(Place not selected)*
ILLINOIS WATER PLANT OPERATORS CONFERENCE, ANNUAL MEETING. Clarence W. Klassen, Chief San. Engr., State Dept. Public Health, Springfield, Ill.,

Oct. 10-13—Atlantic City, N. J. *(Ambassador Hotel)*
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSOCIATION. (Annual Meeting). Sec'y, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.

(joint meeting with)

Oct. 10-13—Atlantic City, N. J. *(Ambassador Hotel)*
NEW JERSEY SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, M. S. Kachorsky, P. O. Box 766, Manville. N. J.

Oct. 11-14—Atlantic City, N. J., *(Chalfont Hotel)*
PENNSYLVANIA WATER WORKS ASSOCIATION (Annual Meeting) Sec'y, Davis Dunlap, 2609 N. Second St., Harrisburg, Pa.

Oct. 12—Norridgewock, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Oct. 16-19—San Antonio, Tex. *(Gunter Hotel)*
SOUTHWEST SECTION A.W.W.A. Sec'y, Leslie A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 17-19—Pittsburgh, Pa., *(Hotel William Penn)*
16th ANNUAL WATER CONFERENCE, W. M. Porter, Sec'y., The Engineers Society of Western Pensylvania, Hotel William Penn, Pittsburgh 30, Pa.

Oct. 19-20—Clarksburg, W. Vir. *(Waldo Hotel)*
WEST VIRGINIA SEWAGE & INDUSTRIAL WASTES ASSOCIATION (9th Annual Meeting) Sec'y, G. O. Fortney, State Dept. of Health, Charleston 5, W. Vir.

Oct. 19-21—Des Moines, Ia.
IOWA SECTION A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Ia.

Oct. 20-21—Clarksburg, W. Va. *(Waldo Hotel)*
WEST VIRGINIA SECTION A.W.W.A. Sec'y, Harry K. Gidley, State Dept. of Health, Charleston, W. Va.

Oct. 20-22—Atlantic City, N. J. *(Madison Hotel)*
NEW JERSEY SECTION A.W.W.A. (Fall Meeting). Sec'y, C. B. Tygert, Box 178, Newark, N. J.

Oct. 24-28—New York, N. Y. *(Hotel Statler)*
AMERICAN SOCIETY OF CIVIL ENGINEERS. (Annual Meeting). Sec'y, Wm. N. Carey, 33 West 39th St., New York, N. Y.

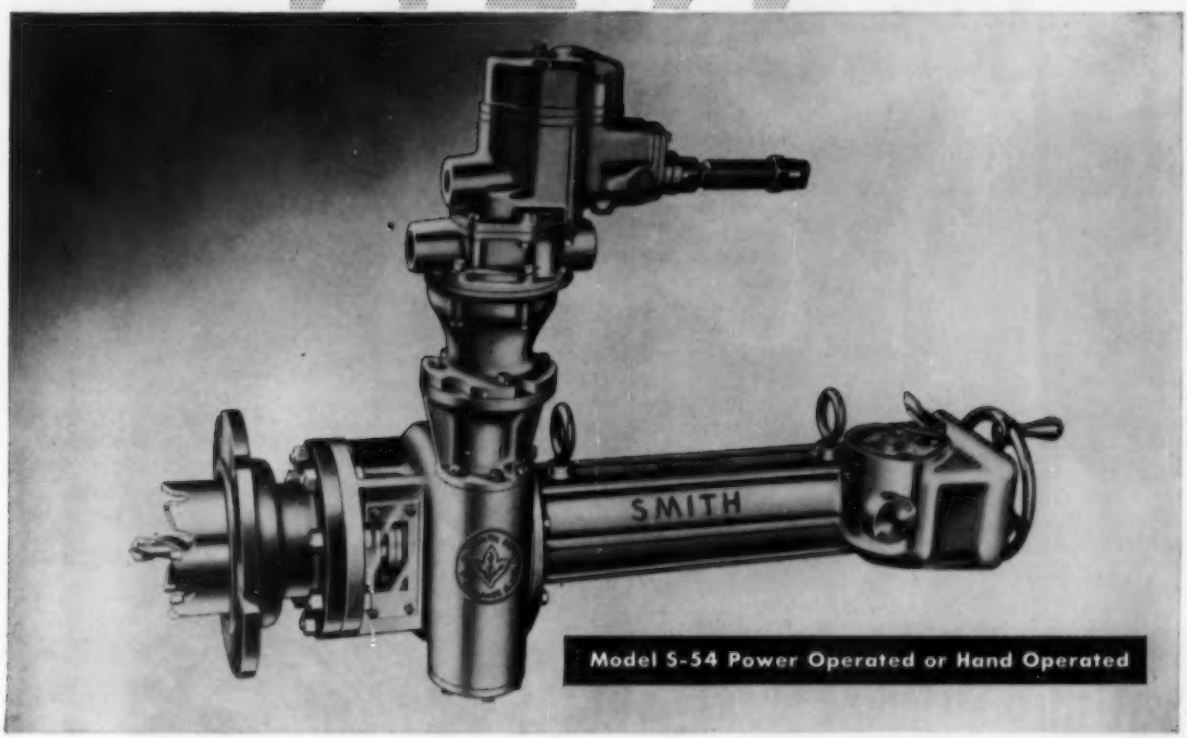
Oct. 25-28—Sacramento, Calif. *(Senator Hotel)*
CALIFORNIA SECTION A.W.W.A. Sec'y, Henry F. Jerauld, 1040 Manzanita, Pasadena, Calif.

Oct. 26-28—Washington, D. C. *(Hotel to be announced)*
CHESAPEAKE SECTION A.W.W.A. Sec'y, Carl J. Lauter, 6955—33rd St., Washington, D. C.

Oct. 30-Nov. 2—Biloxi, Miss. *(Buena Vista Hotel)*
ALABAMA-MISSISSIPPI SECTION A.W.W.A. Sec'y, Charles W. White, 537 Dexter Ave., Montgomery, Ala.

Nov. 3-5—Richmond, Va. *(Jefferson Hotel)*
VIRGINIA SECTION A.W.W.A. Sec'y, J. P. Kavanagh, 213 Carlton Terrace Bldg., Roanoke, Va.

NEW SMITH TAPPING MACHINES FOR TAPS 2″ THRU 12″ INCLUSIVE



Model S-54 Power Operated or Hand Operated

The A. P. Smith Mfg. Company in 1896 introduced the first Tapping Machine for making connections sizes 2″ and larger to fluid and gas service piping under pressure. The *NEW* Smith S-54 Tapping Machine is the most modern, efficient and economical machine available. The S-54 Smith Tapping Machine is used with Tapping Sleeves, Hat Flanges, Saddles and Tapping Valves to make 2″ through 12″ connections under pressure to Cast Iron, Cement-Asbestos, Steel and Reinforced Concrete Pressure pipe. 1. AUTOMATIC FEED: Positive automatic feed insures correct drilling and tapping rate. Hand feed is provided to rapidly advance and withdraw Cutter. 2. TRAVEL INDICATOR: Chart attached to machine indicates travel required to complete tap. Travel is *AUTOMATICALLY* terminated when tap is completed. Cutter and shaft cannot overtravel. 3. COMPACT CONSTRUCTION: Telescopic shaft reduces overall length. 25″ travel is adequate for 2″ through 12″ taps to any size of pipe. 4. ENCLOSED CONSTRUCTION: Mechanism is housed in heat treated Aluminum Case filled with lubricant. Foreign matter cannot enter and damage mechanism. 5. STUFFING BOX AND PACKING GLAND: Accessible without disassembling machine. Equipped with Chevron packing. Line pressure cannot enter machine case. 6. RUGGED CONSTRUCTION: Extra large diameter telescopic shaft adds strength and rigidity. Timken radial—thrust bearings maintain alignment, reduce friction and wear. 7. DRIVING GEARS: Worm gearing operates in lubricant, torque is reduced to the minimum. 8. CUTTERS: Have replaceable Flat and Semi-V alternate teeth of High Speed Steel or Tungsten Carbide. 9. FLEXIBILITY: Hand Operated Machines can be converted to Power Operation by interchanging worm gearing. 10. AIR MOTOR: The motor attaches directly to the Power Operated Machine without Brackets, Holders, Adapters or Couplings. Bulletin sent on request.

52

FIRE HYDRANTS · VALVES · SINCE 1896

THE A.P. SMITH MFG. CO.

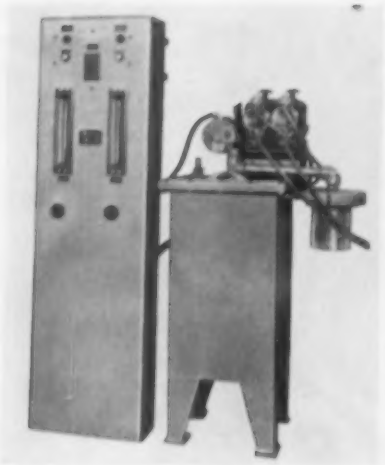
EAST ORANGE, NEW JERSEY

• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

W&SW

New Equipment

Omega Silica Activator



Omega Machine Co., Providence, R. I., has announced the development of its Model 63 Activator for the continuous preparation and feeding of activated silica.

The Activator includes all features required for continuous silica activation and is easily adjusted to prepare the activated silica sols most effective for specific treatment conditions. Once the mixture is prepared in a transparent mixing tank it flows to a separate aging tank for a controlled aging period. The aged activated silica is then diluted for delivery to the point of application.

Some of the advantages claimed for this Omega Activator include a central control panel, for ease of operation; a continuous process, eliminating batching of activated silica sols; and sequence starting. The unit also permits reagent selectivity in the choice of alum, chlorine, sodium bicarbonate, sulfuric acid and ammonium sulfate; a variation of aging concentration and aging time assuring operational flexibility; and anti-gel interlock which stops activant feed if raw silicate supply fails.

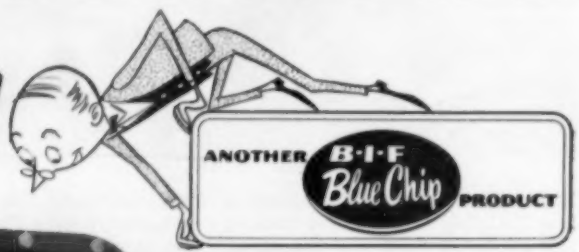
New Ditcher

Gar Wood Industries, Inc., Wayne, Mich., has announced the introduction of a new pipeline and utility ditcher, the Buckeye model 308.

The Buckeye 308 is a heavy-duty,

(Continued on page 84A)

What a Meter for Water!



BUILDERS PROPELOFLO is an inexpensive main line meter for totalizing water consumption. Gives dependable, trouble-free service on the job. Meters accurately over wide range — six-digit totalizer shows water use directly in gallons, cubic feet, etc. For complete information on this easy-to-install meter, write to Builders-Providence, Inc., 350 Harris Ave., Providence 1, Rhode Island.

BUILDERS-PROVIDENCE

DIVISION OF B-I-F INDUSTRIES, INC.

BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC. • OMEGA MACHINE CO.

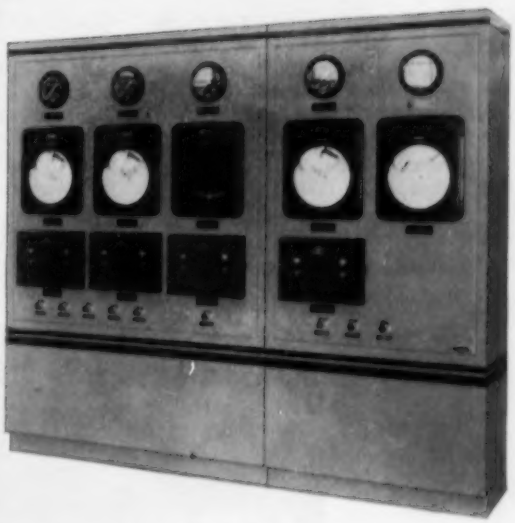
B·I·F METERS FEEDERS CONTROLS

Completely Modern . . . Completely Controlled . . .

with Foxboro Automatic Control for Rapid Sand Filters

This trim, new municipal water treatment plant at Fairfield, Cal., is ultra-modern inside and out. Automatic control of the plant's four rapid sand filters is handled by the highly flexible Foxboro System shown in the accompanying illustrations. *Contractor: C. Norman Peterson, Co., Berkeley, Cal. Consulting Engineers: Solano Engineers Associated, Vallejo, Cal.*

Supt. Charles A. Crane turns "finger-tip" control selector switch on one of four Foxboro Master Operating Tables at Fairfield plant. Using switch, he can shut off influent or by-pass effluent to waste; start filtration or backwashing at pre-set rates. In addition, he can re-set rates at any time, without moving from table. Operating table is integrated with automatic control cabinet (right) to provide high versatility . . . maximum ease of operation.



Five instruments across center, l. to r., are recording and integrating — or controlling — influent and effluent flows, clearwell level, backwash rate, and effluent temperature. Timers (beneath) operate with influent flow recorder to proportion chemicals to influent.

Clean-cut, all-pneumatic operation of Foxboro Automatic Control for Rapid Sand Filters pays off in lowest cost installation, minimum maintenance, and greatest convenience. It's unaffected by backwash and sand . . . requires no drum, pulley, or cable servicing. Rugged d/p Cell Transmitters handle loss-of-head and filter rate measurements. Long-life, rubber-lined butterfly valves assure positive shut-off action.

For full details on the economy *and* convenience of this modern system, write for illustrated Bulletin.

THE FOXBORO COMPANY, 896 NEPONSET AVE., FOXBORO, MASSACHUSETTS, U.S.A.

FOXBORO REG. U. S. PAT. OFF.

AUTOMATIC CONTROL for RAPID SAND FILTERS

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

wheel-type ditcher especially designed for digging cross-country ditch and for city gas, water, oil, sewer, conduit and cable lines. It digs to a maximum depth of 5'6" with optional width of cut varying from 16" to 32" increments. The new Buckeye 308 is exceptionally fast and flexible in all types of soils and under almost any job condition.

A live hydraulic wheel hoist provides fast and accurate positioning of the digging wheel. The hoist is operated by simple one-hand controls from the operator's seat and the lowering and raising of the digging wheel is completely independent of digging, wheel or crawler speeds.

New High-Voltage Motor Control

General Electric Company, Schenectady, N. Y., has announced the development of a new Limitamp high-voltage motor control that saves more than 50 per cent in floor space over previous models.

A high-voltage fused starter for co-ordinated control of motors up to 3000 horsepower on 2300- to 4800-volt systems, Limitamp control offers better protection against circuit faults up to 60,000 amperes, according to G-E engineers. Designed to give maximum short-circuit protection, fuses of high interrupting capacity limit current flowing in a fault within one quarter of a cycle and interrupt within one-half cycle.

Two construction features make this floor space saving possible. The new Limitamp units are only 30 inches deep, exactly one-half the depth of previous standard enclosures. Being all front connected, the new enclosures can be mounted back-to-back or back-to-wall, and no back aisle is required.

Two-Pen Round Chart Recorder

The Bristol Company, Waterbury, Conn., has developed a new round-chart Electronic Dynamaster Potentiometer recorder that can make two continuous records at the same time on a 12-inch round chart.

In many applications, records of two related measurements must be closely compared with respect to the magnitude and time of any variations from the desired value. With both records on the same chart, such comparison is simpler and more accurate than when two separate charts must be studied.

The Dynamaster potentiometer and bridge instruments can be used to measure and control any variable which can be translated into an electrical quantity, such as temperature, pH, consistency, speed, pressure, weight, and others.

Odorless Sanitary Cleaner

Gorman-Rupp Company, Mansfield, Ohio, has just announced a new model Odorless Sanitary Cleaner. It is a packaged pump and tank apparatus for truck mount, fully enclosed, for the clean, quick and easy servicing of septic tanks, cesspools, sewage filtration beds and lagoons.

Consisting of integral pump and tank apparatus, the O. S. C. mounts to standard truck chassis 158 to 161 inches. Pump is Gorman-Rupp self-priming centrifugal Model 1405, with removable end plate, two vane trash-type impellers to handle solids of two inch diameter, renewable wearplate, grease lubricated shaft seal, close-coupled to Wisconsin VE-4D air-

(Continued on page 86A)

NoDrip® ...STOPS CONDENSATION DRIP

NoDRIP PREVENTS RUST —ANYONE CAN APPLY

NoDrip plastic coating is easily applied to tanks, containers, suction lines, vats, pipes, walls, ceilings, etc. NoDrip adheres to metal, concrete, brick, plaster. It forms a seamless 100% moisture-proof covering that is effective as soon as dry. Acid, alkali and brine resistant.

FREE... Interesting 32-page Handbook shows what NoDrip is and what it does. SEND COUPON TODAY

SEND NoDRIP HANDBOOK

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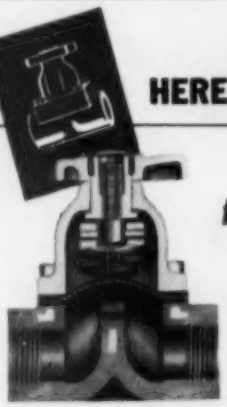
CITY_____ STATE_____

J. W. MORTELL CO. • 599-F BURCH ST. • KANKAKEE, ILL.
TECHNICAL COATINGS SINCE 1895

HERE'S *the* VALVE



for all-plastic piping systems

Choice of non-toxic, odorless, non-contaminating Ace Parian (polyethylene) or Ace Saran ... handles most corrosive chemicals and ingredients. Diaphragm is rubber, neoprene or polyethylene. Bonnet assembly sealed from solution. Can be serviced without removing from line. Hills-McCanna, Saunders principle. All sizes ½" to 2", for 50 psi. at 77 deg. F. Ace also offers *eight* types of plastic and rubber pipe, many valves, pumps, etc.; write today.

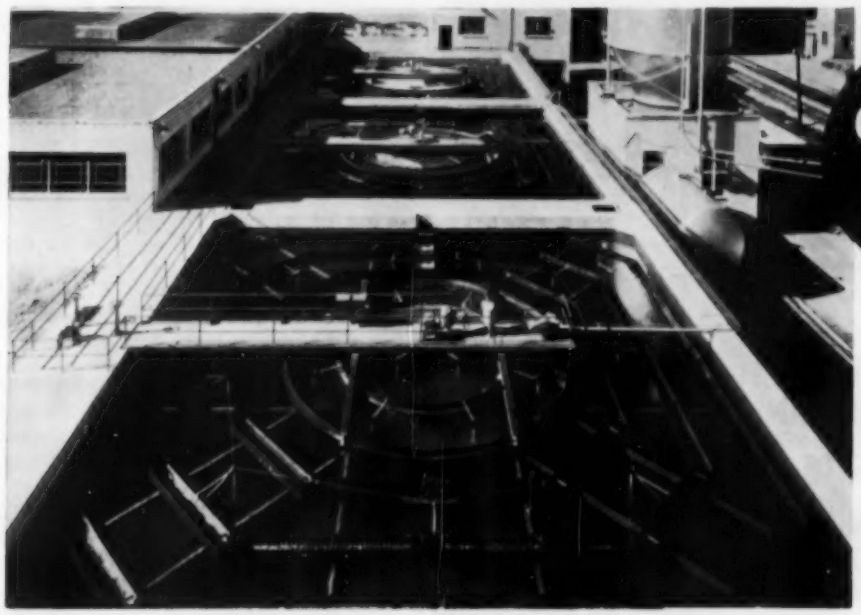
ACE rubber and plastic processing equipment • SINCE 1852

AMERICAN HARD RUBBER COMPANY, 93 Worth St., New York 13, N. Y.

WALKER PROCESS

Clariflow

Orlando, Florida Water Treatment Plant includes three Walker Process Clariflows for lime softening as well as algae and color removal. The unit in the foreground, completed in 1954, increases the plant capacity to 24 MGD. The two original Clariflows were installed in 1949. Each unit is 56' square x 17' deep.



ORLANDO, FLORIDA

Consulting Engineers—Robert & Co., Atlanta, Ga.
Gen'l. Mgr.—Orlando Utilities Commission—Mr. C. H. Stanton, Mgr.
Orlando Water Dept.—Mr. L. L. Garrett

The Clariflow combines flocculation, good fluid mechanics and clarification in a relatively small tank. Mixing, flocculation, stilling and sedimentation are independently operated and controlled. The positive control of flocculation and clarification enables the operator to readily select the most economical method of operation when handling changeable water conditions.

Short circuiting tendencies are eliminated by means of exclusive multiple, tangential diffusers which simultaneously and equally distribute the flow. Balanced multiple surface weir troughs make efficient use of short detention periods and insure clarified overflows.

The Clariflow is applicable wherever there is a municipal or industrial need for water or waste treatment. It can be used in all operations including combined intimate chemical homogenizing flocculation and clarification in rectangular, square or circular basins. The Clariflow gives excellent results in the treatment of municipal and industrial water for—softening—turbidity removal—color removal—algae removal. Industrially it is universally used in—oil separation and emulsion breaking plants—blast furnace flue dust thickening—paper stock reclamation.

Write for bulletin 6W46.

WALKER PROCESS EQUIPMENT INC.
FACTORY—ENGINEERING OFFICES—LABORATORY
AURORA, ILLINOIS

cooled 21 h.p. engine, with electric starter.

Tank is 1100 gallon capacity built of 12 gage steel, complete with sand drainage sump, manhole cover and safety control limiting fills to 1000 gallons, on 10 gage steel frame. Positive acting, lever controlled lubricated plug valves regulate flow within piping, pump and tank.

Pump connections and piping are designed for both pumping and jetting through a single 3″ hose or separate hoses, 3″ suction, 2″ discharge. Pumping capacity varies with engine speed and job condition and ranges up to 500 gallons at 39 pounds pressure.

Speed-Trol Separate Motor Drive

Sterling Electric Motors, Inc., Los Angeles, Calif., has announced that the Sterling Speed-Trol Variable Speed Transmission is now available as a separate motor drive. Through means of a flexible coupling and mounting shelf, any foot mounted motor can be coupled with the Speed-Trol Variable Speed Transmission. The Speed-Trol can now be supplied with separate mounted explosion proof motor for locations in hazardous areas as well as drip-proof and totally enclosed motors.

All Weather Pipe Wrap Tape

Minnesota Mining and Manufacturing Co., St. Paul, Minn., has developed an all weather, polyvinyl chloride pipe wrap tape featuring increased adhesion and conformability even at freezing temperatures.

The plastic tape is a new, improved version of the firm's "Scotchrap" pipe insulation and is stated to be the first pressure-sensitive, polyvinyl chloride tape formulated exclusively for pipeline corrosion prevention.

The new material was under development for more than two years and was then field evaluated by two large distribution systems for a year as "Scotchrap" pipe insulation No. X-1030 and X-1031. Experience has shown that the new tape can satisfactorily be applied in temperatures as low as zero degrees F., according to the manufacturer.

In addition to its low-temperature flexibility, the new tape features an improved adhesive that sticks better at all temperatures employing a built-in corrosion inhibitor identifiable by its green cast.

All-Weather Protection For Galvanized Iron

Tropical Paint Co., Cleveland, Ohio, has developed a new priming paint, "Zincoater," that provides excellent all-weather protection for galvanized iron or sheet zinc.

Zincoater is formulated by combining zinc dust with a vehicle to provide a smooth, continuous film for full protection. Finish coats cling tightly to Zincoater primer, which has an eggshell finish. Laboratory tests indicate that the primer protects new metal better than galvanizing.

Tropical recommends the primer for such exacting applications as galvanized iron building surfaces or towers, painted outdoor signs, water

(Continued on page 88A)

OAKLAND CAN REMOVE
648 MILLION GALLONS OF STORM WATER PER DAY
WITH FOUR HUGE WHEELER-ECONOMY PUMPS

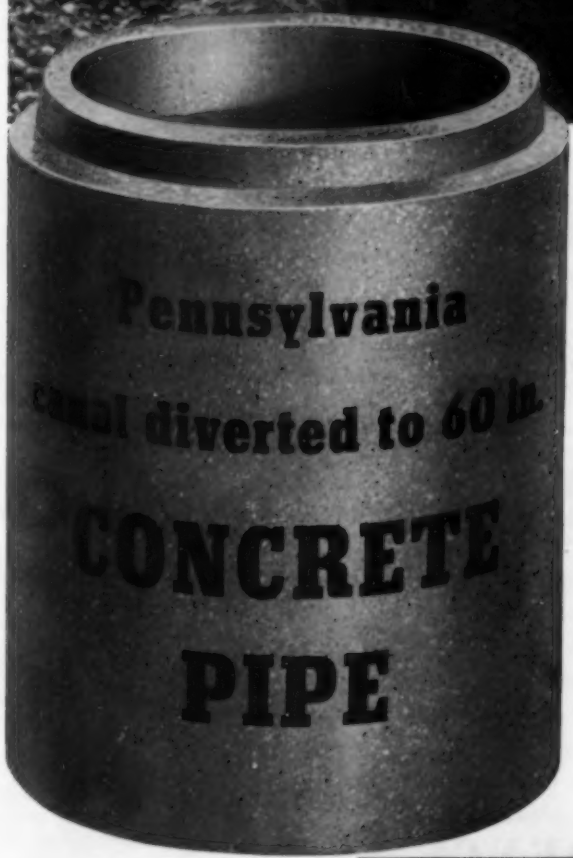
Each of the four Wheeler-Economy Vertical Mixed-Flow Pumps in the new Oakland Storm Water Pumping Station has a capacity of 112,250 g. p. m. They are among the largest pumps ever built—54 x 66 in., weighing approximately 20 tons apiece. Average head is 31 ft. with pump inlets nearly 25 ft. below the engine floor. In any development of the magnitude of the Oakland, California storm water project, pump performance must measure up to the millions of dollars invested. Wheeler-Economy has pioneered in the development of large axial and mixed-flow pumping equipment. That's why so many municipalities play it safe with Wheeler-Economy engineering skill and experienced workmanship. (Write for Bulletin on the Oakland story.)

One of huge Wheeler-Economy Pumps at Oakland, California. Conduit sizes draining into pumping station range from 24 to 108 in., large enough for an automobile.

WD-011

WHEELER-ECONOMY PUMPS

ECONOMY PUMPS INC DIVISION OF C H WHEELER MANUFACTURING CO
10TH AND LEHIGH PHILADELPHIA 32 PA



A special problem faced engineers building the giant new housing development, Levittown, Pa. The old Pennsylvania Canal flowed through the heart of the commercial district. The problem was solved by diverting the canal through 60-in. concrete pipe laid alongside, as shown above.

The old bed was filled, and the hidden canal now flows through 1528 ft. of buried pipeline, unimpeded by commercial buildings overhead.

Engineers everywhere, like the engineers who built Levittown, can depend on concrete pipe in solving water and sewage problems. Its great strength withstands severe impact and overburdens. Its uniformly dense structure and its watertight joints assure minimum infiltration and leakage. The smooth interior resists abrasive action, provides maximum hydraulic capacity.

Investment in concrete pipe buys long service with moderate first cost and little maintenance. The result is ***low-annual-cost*** pipeline service.

AMERICAN CONCRETE PIPE ASSOCIATION
228 NORTH LA SALLE STREET, CHICAGO 1, ILLINOIS

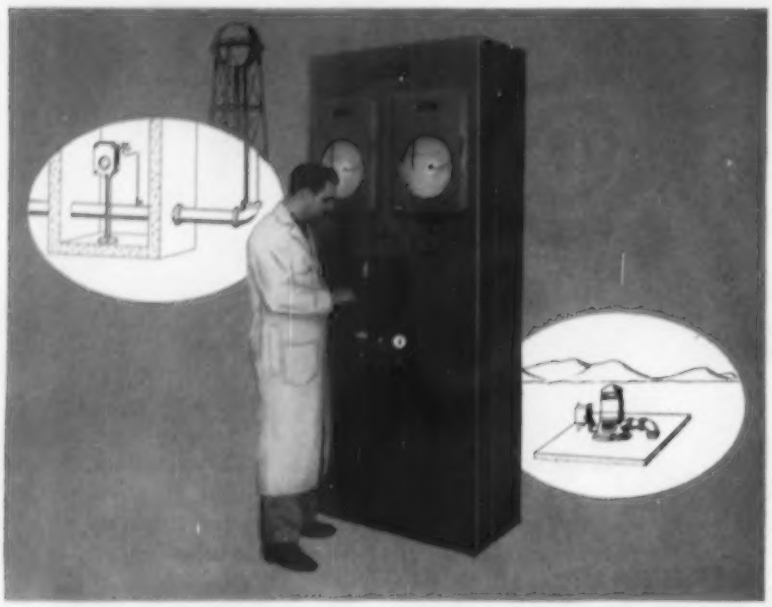
tanks, etc. Zincoater is said not to affect the purity of water for drinking or manufacturing purposes.

d/p Cell Transmitter

Foxboro Company, Foxboro, Mass., has announced that major advances in design have been incorporated in a new force balance flow transmitter as an addition to its line of differential pressure flow measuring instruments. Designated the 13A d/p Cell Transmitter, it measures differential pressures and transmits a 3-15 psi signal to a receiving, recording or controlling instrument.

The new transmitter provides continuous adjustment over the entire range of 0-50" to 0-250" of water differential without change of parts.

Unitized "block" construction of the three basic parts—body, transmitter and air relay—eliminates the effects of piping stresses. Operating on the force balance principle, the all-metal measuring components and temperature-stable parts such as the Elgiloy stainless alloy sealing diaphragm, maintain calibrated accuracy over a wide range of ambient conditions.



SYSTEM SUPERVISION IS SIMPLE AND ECONOMICAL WITH *Synchro-Scan**

ANOTHER B·I·F Blue Chip PRODUCT

Builders-Providence Synchro-Scan Supervisory Control gives you the economy of being able to operate remote equipment from a centralized control station — plus the extra economy of extreme simplicity: — basically right in its design, easy to operate, and easy to maintain.

May we tell you about Synchro-Scan Supervisory Control — the only control with the unique "building block" design. Send, today, for new Bulletin 240-M6. Builders-Providence, Inc., 350 Harris Avenue, Providence 1, Rhode Island.

*Patent applied for

BUILDERS-PROVIDENCE

DIVISION OF B-I-F INDUSTRIES, INC.

BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC. • OMEGA MACHINE CO. — BIF METERS FEEDERS CONTROLS

Chain Wrench

Reed Manufacturing Company, Erie, Pa., has announced a new design in chain wrenches.

The new Reed chain wrench is said to out-perform the conventional pipe wrench in several important aspects. The chain-and-jaw grip permits working in tight corners, between parallel pipe lines, or wherever there is too little clearance for the head of a conventional wrench. It is also possible to tighten and back off a pipe or fitting without taking the wrench from the pipe or changing the setting.

Although the jaws of the wrench are of hardened steel, they are easily replaceable, extending the life of the tool indefinitely. Their design permits a fast, ratchet-like action in either direction from either side of the pipe or fitting.

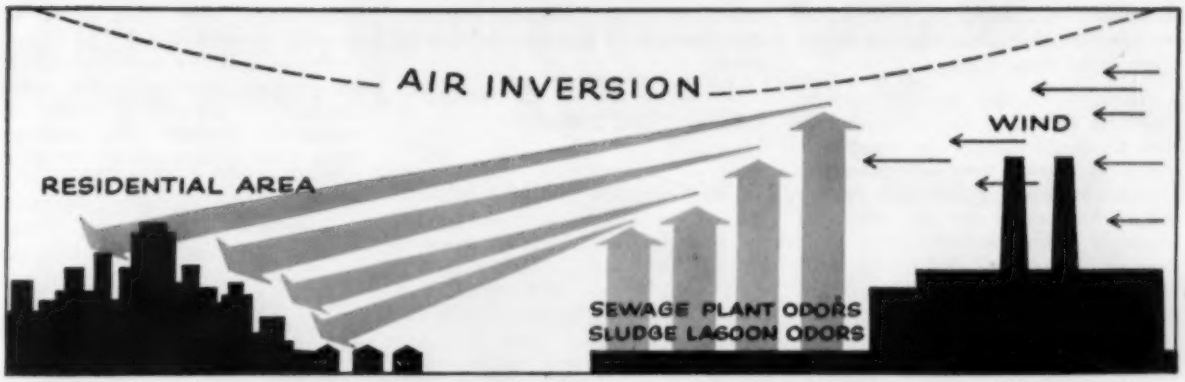
The Reed wrench is extremely versatile in that it will hold and turn any shape . . . round, square, hex or irregular . . . firmly, without play and without crushing.

Remote Control For Water Utilities

Hammarlund Manufacturing Company, New York, N. Y., has announced that centralized control of pumps, valves and other equipment by water supply companies can be accomplished by remote control and telemetering, using a single communications circuit.

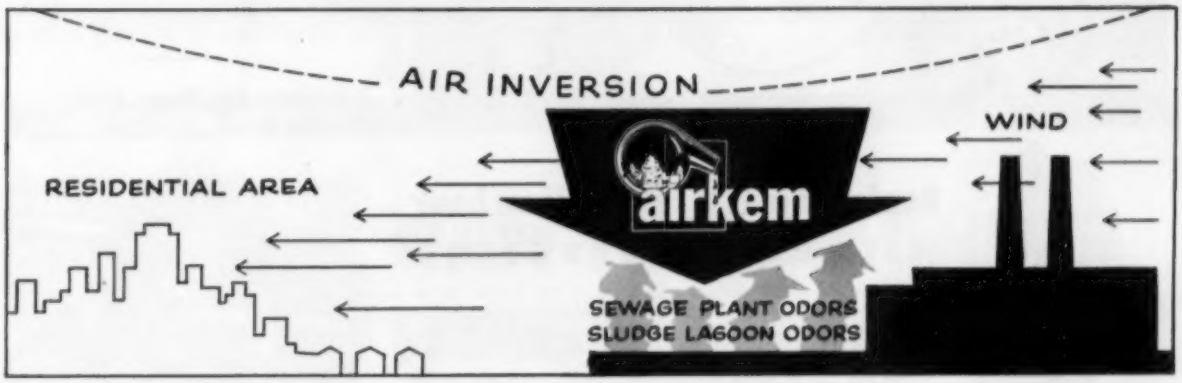
The equipment which provides Centralized Operations Control of water systems makes use of audio tones for sending signals for On-Off and Raise-Lower controls of pumps, valves and other remotely located equipment, and the simultaneous and

(Continued on page 90A)



A multi-million-dollar sewage treatment plant was in trouble. Despite "care, cleanliness and chlorine," unpleasant odors were invading the homes of 30-thousand nearby residents.

AIRKEM took this problem and solved it!



Stumped for an economically-sound solution, officials called in Airkem's Industrial Odor Service. After carefully analyzing the problem, the odor trouble-shooters installed simple, low-cost equipment for dispensing a new Airkem product formulated specifically to counteract airborne sewage odors.

Results were immediate and gratifying. The odors were gone. And not only were good relations re-established with the neighbors, but the plant staff was pleased as punch with their improved working conditions. Best of all, the results had been accomplished at moderate cost and without affecting plant operation.

If odors are damaging your plant's public relations, it will pay you to call in Airkem's Industrial Odor Service specialists. They have the low-cost answers to sewage odor problems of widely differing types and degrees of complexity. And behind them are the facilities of the world's largest laboratory devoted exclusively to the study and solution of odor problems.

Consultations are strictly confidential, incur no obligation. Call your local Airkem representative now (he's listed in your phone book), or write today to Airkem, Inc., 241 East 44th Street, New York 17, N. Y.

FOR INDUSTRIAL • MUNICIPAL
INSTITUTIONAL • COMMERCIAL USE

airkem ODOR COUNTERACTANTS

continuous reporting of information on pressure, flow, and other necessary data from those points.

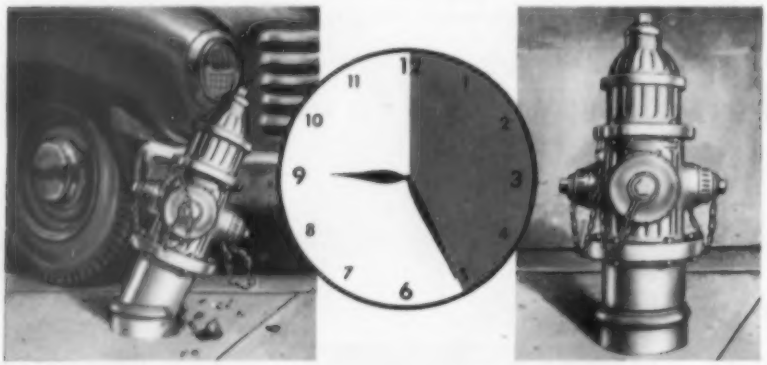
Because of the simple, modern, modular design of the equipment, it can be easily handled by water systems engineers without extensive electronic training. Considerable savings result because of the elimination of multiple communications lines often needed for control, and by the basic simple operation of the system. The control equipment works with either impulse-duration types of telemetering or the low frequency FM equipment, providing continuous information display at the central control points.

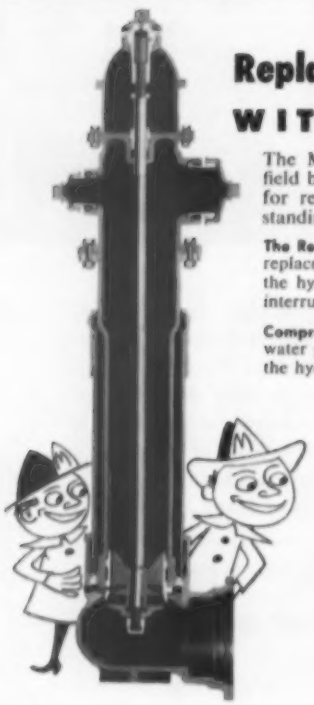
Coatings And Linings

The Corrosion Control Company, Inc., announces the introduction of its new line of chemical resistant coatings and linings. Called Neocor C-10 and Neocor HD series, both series neoprene based are effective protection against a great many corrosive reagents as well as over a wide temperature range. Both series cure at room temperature.

Neocor C-10 is a room temperature one package spray or brush coating applicable to any type of surface and resistant to chemical spills, fumes and drips with a temperature range of —20 F. to 275 F. Brushed on coats of Neocor C-10 give a dry film thickness of 4-5 mils per coat. Neocor C-10 coatings are unaffected by sunlight and weathering and cure to tough abrasion resistant rubber films. Standard colors are black, light grey, dark grey, red and aluminum.

Neocor HD is a two package room temperature curing chemical resistant lining designed for immersion service over a wide temperature range. Neocor HD may be brushed or sprayed by regular plant maintenance men and when cured at room temperature is equal to if not better than most baked linings. It has an effective temperature range from —65F. to 300 F. Brush or spray applications have been accomplished to give a film thickness of 20-30 mils per coat the equivalent of 20-30 coats of ordinary coatings.





Replaced in less than half an hour

WITHOUT EXCAVATING

The Mathews Modernized Hydrant is the leader in its field because it is simple in design and quickly accessible for repair or replacement. Here are some of the outstanding features of the Mathews Modernized Hydrant.

The Replaceable Barrel. Contains all working parts and can be replaced with another in jig time *without excavating.* When the hydrant is broken in a traffic accident, fire protection is interrupted for less than 30 minutes!

Compression-Type Main Valve. The Mathews Hydrant uses water pressure to help tighten the valve. No leaks, even when the hydrant is bowled over by a truck.

Stuffing Box Plate. Cast integral with the nozzle section, eliminates an extra part and a flange joint. A stronger, safer, leakproof construction.

Operating Thread. The stuffing box plate prevents water and sediment from reaching the operating thread. No rust can form. No ice can jam it in cold weather.

And all these other quality features: Head turns 360° simply by loosening bolts • Replaceable head • Nozzle sections easily changed • Nozzle level can be changed without excavating • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • A modern barrel makes an old Mathews good as new • Mechanical joint pipe connections optional.

Send for this 80-page catalog. It contains full information about the R. D. Wood line of Cast Iron Pipe, Fire Hydrants, Gate Valves, and Hydraulic Machinery.

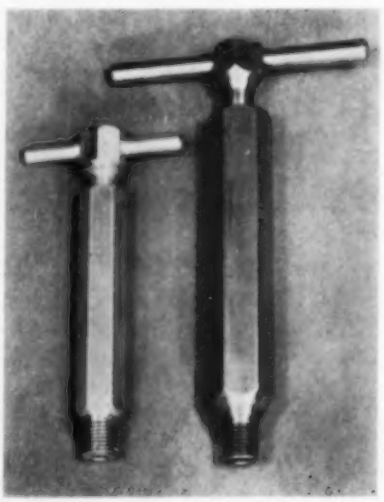
MATHEWS HYDRANTS

Made by R. D. Wood Company

Public Ledger Building, Independence Square
Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

Lubricator For Pump Shaft Stuffing Boxes



Rockwell Manufacturing Company, Meter and Valve Div., Pittsburgh, Pa., has just made available an extension lubricator for injecting lubricant as packing in pump shaft stuffing boxes. Previously made up for individual customers at their request, the lubricator is now available as a stock item to meet the demand from pump makers and users.

Available in brass or cadmium-plated steel, the new accessory comes in two over-all lengths—6⅜ inch and 8 7/16 N.P.T. thread connector. The

(Continued on page 92A)

RICHFIELD, MINNESOTA, chose "Flexibles" to help protect its New 5 MILLION DOLLAR Sewer System INVESTMENT!

Without a sanitary sewer system two years ago, Richfield is now in the final stages of a five million dollar sewer improvement program to serve its rapidly increasing population, which is now over 32,000. For this, as well as other civic achievements, Richfield was selected as one of eleven "All America Cities" for 1954 by Look Magazine in cooperation with the National Municipal League. To aid in protecting the sewer investment, "Flexibles" were selected. Pictured watching a set of "Flexible" Bucket Machines on the job are Robert Long, Superintendent of Streets and Parks; Leroy Trafton, Village Manager; Fred Kittell, Mayor; Councilmen John H. Rose and John Shields; and Egil Wefald, Director of Public Works.

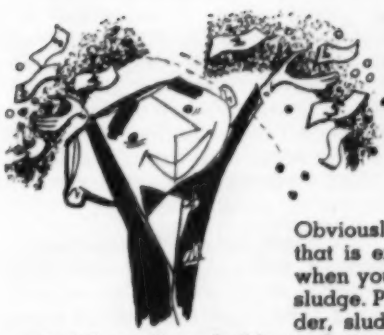
Flexible SALES CORPORATION

3786 DURANGO AVE., LOS ANGELES 34, CALIF.

(Distributors in Principal Cities)

Send for FREE CATALOG.

AMERICA'S LARGEST LINE OF PIPE CLEANING TOOLS AND EQUIPMENT



CAN YOU AFFORD TO THROW MONEY AWAY?

Obviously, the answer is "no". But that is exactly what you are doing when you burn or bury your sewage sludge. Prepared with a Royer Shredder, sludge is a valuable fertilizing material, easily saleable to florists, nurserymen, golf courses and gardeners. By making this product available to your community you are doing them a service and at the same time earning a cash return.

The operation is simple. Sludge cake direct from the drying beds is fed into the hopper of the Royer Shredder where it is shredded, mixed, aerated and discharged to bag, pile or truck . . . free of all trash, ready for use. Low capacity, hand fed units are available for small operations . . . huge, bucket loaded 150 cubic yard per hour models for larger disposal plants.

Don't throw money away . . . either by unnecessary disposal costs or by failing to sell a wanted product. Send for Bulletin 55-S giving complete information on the Royer Shredder and its use in sewage sludge disposal.

ROYER foundry & machine co. ROYER

170 PRINGLE ST., KINGSTON, PA.

longer model with larger lubricant barrel is available with either ¼"-18 or ⅜"-18 N.P.T. thread connector.

Water Conditioner Eliminates Scale, Corrosion Without Chemicals

The Packard Manufacturing Company, Jacksonville, Florida, has developed a new water conditioner that eliminates and prevents corrosion and scale formation in boilers and water systems. It is the first important commercial application of nuclear physics principles to the effective treatment of an industrial problem.

The Packard Water Conditioner prevents scale and corrosion by imparting added energy to the atoms of the water solution.

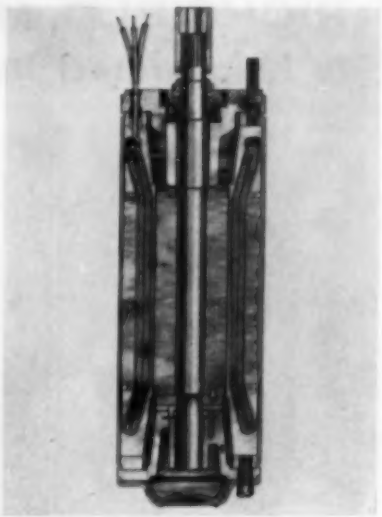
The unit is easily installed. It has no moving parts and requires no expensive maintenance or servicing either in the form of labor or added chemicals.

The Packard Water Conditioner is manufactured in sizes handling from 6.5 to 1760 gallons per minute for connection with corresponding standard iron pipe ranging from ¾" to 12".

Conditioners are guaranteed for a period of ten years.

WE KNOW
VALVES & HYDRANTS
About an egg beater or an A-bomb we know little or nothing. But with valves and hydrants, it's different!
For many years we have been making M&H Valves, Hydrants and accessories on the same basic design — a design originally conceived by applying exhaustive research and careful engineering to practical knowledge of foundry production and water works operation.
As we learned new things during the past, we have made improvements. Our goal has been to make the best valves and hydrants money could buy. So, from year to year our sales have grown. Our company has now become a leading producer of valves and hydrants. And — if and when better valves and hydrants ever are made, we expect them to be M&H.
We know valves and hydrants. For details, write M&H VALVE & FITTINGS COMPANY, Anniston, Alabama.
MH
M&H PRODUCTS
FOR WATER WORKS • FILTER PLANTS
INDUSTRY • SEWAGE DISPOSAL AND
FIRE PROTECTION

New Submersible Motor



U. S. Electrical Motors Inc., Los Angeles, Calif., has announced that a new submersible motor has been perfected for water well pumping.

Incorporating standardized NEMA mounting dimensions, the U. S. Submersible motor is of the "wet" type construction in which entrance of water into the motor will cause no harm to the windings. A special process has been developed for encasement of the copper windings in a plastic armor which is impervious to water within the motor. The plastic is a high dielectric compound that has extremely low water absorption, similar to materials now used to jacket submerged power cables. The motor is immune to such hazards as leaky joints, wear of seals, condensation, impurities, vibration, etc.

To guard against internal corrosion, the motor is factory filled with a highly stable emulsion of oil and water. The oil particles have a polar attraction to metal surfaces and deposit on them, preventing corrosion. Means are provided to maintain this emulsion at an effective concentration for a long period of time.

Continuous Analyzer For Free Residual Chlorine

Leeds & Northrup Company has developed a new Residual Chlorine Analyzer that provides an automatic check on Cl_2 content in chlorinated water. Functioning on the Coulometric principle, the instrument makes a continuous electrical titration for Cl_2 content, and incorporates an L&N Speedomax recorder to chart the variable.

The company reports that a high degree of inherent measuring accuracy and unusually low maintenance are the direct results of the measuring method employed.

Minimum Clearances Stressed In New Trenchliner

Parsons Company, Newton, Iowa, has developed a new ladder-type Trenchliner with minimum overall dimensions and reduced weight without sacrificing heavy-duty performance or digging capacity. Compact design, low center of gravity and low ground bearing pressure are additional characteristics of the new unit, designated as the Model 155 Trenchliner.

In developing the Model 155, Parsons engineers stressed minimum dimensions and clearances. This allows the machine to work in congested areas normally inaccessible to a trencher of this capacity and eliminates costly and time-consuming transportation problems.

The 155 Trenchliner produces from 5.8 inches to 12.75 lineal feet of trench per minute in a range of 30 speed selections by lever control. A higher range of 30 speeds, up to 25 lineal feet per minute, is made available by a simple sprocket change. With a maximum depth capacity of 8 feet and widths from 16 through 26 inches, the Model 155 is ideally suited for a wide work range including sewer, water, gas mains and services.

Gage Illuminators

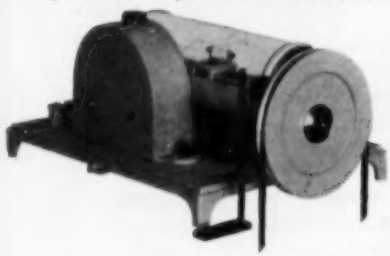
Jerguson Gage & Valve Co., Somerville, Mass., has announced that new efficiency is given to liquid level gage lighting with the company's newly redesigned and improved Gage Illuminators.

These Jerguson Gage Illuminators give an even diffusion of light over the entire length of the gage glass,

SOLVING A DIFFICULT problem | automatically

PROBLEM: To obtain automatic, graphic records of the flow of sewage in a sewer main without the expense of installing a weir and float well.

SOLUTION: Install a STEVENS Type F Water Level Recorder mounted on a bracket in a manhole. Use a scow float to operate the recorder and make a stage-discharge rating of the flow. Or, following construction details and rating tables we provide, also install a STEVENS critical flow control down stream to establish a positive depth-flow relationship.



The planning and efficient operation of any project which involves measurement of flowing liquids is based on flow data which can be obtained with STEVENS water level recorders. STEVENS instruments are at work compiling data on hydroelectric and flood control projects, and in water works, sewage disposal plants, irrigation and industrial installations in all parts of the world.

STEVENS DATA BOOK

...Invaluable for your reference file

144 pages of technical data on recorder installations... plus a wealth of hydraulic tables and conversion tables.

Send $1.00 (No COD's)

LEUPOLD & STEVENS INSTRUMENTS, INC.

4445 N. E. GLISAN STREET • PORTLAND 13, OREGON

Foremost in Precision Hydraulic Instruments Since 1907

with no glare spots or blinding areas, thus enabling the engineer to see the liquid level easily and clearly under all conditions.

They incorporate the principle of solid-wedge lighting combined with plastic. Illumination from a single light source (a 15 w bayonet base bulb on the EPL 51 Model and up to a 60 w medium base bulb on the EPL 54 Model) is reflected from the angular surface of a ¼" thick plastic wedge and flows with evenly diffused intensity through the transparent gage glass. The plastic wedge is mounted in an improved way, leaving a space between the wedge and the glass. This facilitates cleaning and leaves an air-cooling space which allows the illuminator to be used on higher temperature gages.

New Ditch-Witch Trencher

The Charles Machine Works, Perry, Oklahoma, has announced the addition of the Model LD to the Ditch-Witch trencher line. The new trencher features a variable speed transmission and completely new design. Capable of various speeds while digging, this self-contained unit is ideal for any number of light trenching jobs. Controls are conveniently located for operating the trencher from the seat or while standing beside the machine. All drives are safely covered, yet easily accessible.

The standard 6 inch width bucket line is hydraulically controlled to a depth of 36 inches. The bucket line is closed, self-cleaning, and has replaceable tool steel teeth. Spoils can be deposited on either side of the trench with the reversible spoils chute.

f-l-e-x-i-b-l-e pipe cleaning company

9334 So. Norwalk Blvd., Los Nietos, California • P.O. Box 167 • OXford 5-5713
P.O. Box 191, South Houston, Texas • Hudson 6-7927

Take one minute to read the A-B-C's of Water main Cleaning!

How old are the water mains in your city's system? When did you last check on pipe condition...on system pressure? If you are considering raising volume and pressure with bigger pumps, or replacing clogged mains, see Flexible first for these basic ways to save dollars by cleaning these clogged mains and restoring them to top efficiency.

✓ A - More Pressure for better service throughout the system ...for improved fire fighting needs and lower under-writers insurance rates -- all without disturbing the lines themselves. That's the Flexible way!

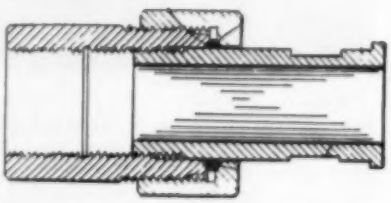
✓ B - Increased Capacity to handle population growth without making unnecessary investments in pumps or larger diameter lines. That's the Flexible way!

✓ C - Lower Cost with experienced crews and specialized equipment that can restore pipe to a guaranteed 90% of new pipe efficiency. That's the Flexible way!

Send -- today -- for our Job Cost Estimate form. We'll be glad to provide our estimate for your particular job, and without cost or obligation.

Flexible has specialized equipment and crews for sterilizing water mains — Write for full details!

Adjustable Coupling For Meter Installations



Jasco Products Co., Houston, Tex., has developed an adjustable coupling to facilitate meter installations.

The tail piece on the coupling has approximately a ½ inch movement and thus allows relative movement in the pipe connection to the meter so that the meter can be tied together without strain or stress on either the meter or connecting pipe. Only one Jasco coupling is required, replacing the standard coupling and tailpiece, and it may be used on any type meter. The coupling eliminates the usual "tight spots" and allows great time savings on meter installations or replacements.

Cambered Boom For Dragshovels

Bucyrus-Erie Co., South Milwaukee, Wis., has developed a cambered boom for dragshovels that offers greater digging depth, digging radius and digging force plus easier dumping. The efficient front-end design is particularly useful in digging sewer trenches, basements and pipelines or conduits as well as for other utility and small contracting jobs.

Heavier boom contributes to a powerful digging stroke. Cambering of the boom allows extra room for digging over corners of the crawlers. As a safety feature, the dragshovel can be positioned further from the edge of embankment.

The dipper design has also been changed to provide more heel clearance, an increased slope to dipper sides for cleaner dumping, a longer lip which dips in easier and offers a longer shelf for heaping higher loads, and side cutters with straight cutting edges which offer less resistance to penetration. In addition, the dipper can be raised higher and brought in closer without spillage.

Small Rubber Tire Ditcher

Barber-Greene Co., Aurora, Ill., has developed a small, rubber-tired ditcher which can "take it" under adverse digging conditions.

This new ditcher, Model 702, can be equipped with either of two digging booms. One digging 30 inches deep can be equipped with either a 2¼-inch or 4½-inch bucket line. The other, digging 40 inches deep can be equipped with a 2½-inch or 5-inch lines. Switching from one digging width to another involves a change in bucket line, a job so simple that one man, with only hand tools, can perform it in 15 or 20 minutes. A simple system of rotating paddles and plows place the spoil neatly at the edges of the trench, facilitating backfilling and eliminating the need for a cross conveyor.

Byron Jackson Acquires Drill Pipe Protector Patents

Byron Jackson Co., Los Angeles, Calif., has acquired world-wide patent rights from Huntsinger Associates for the Vetco "Off-n-on" Drill Pipe and Casing Protector, formerly manufactured and distributed by Ventura Tool Company.

This addition to the line of PB rubber products will be known as the "PB Safe-Lok Protector." It will be manufactured at Byron Jackson's PB rubber plant in Los Angeles and distributed by the company's Oil Tool Division.

Ground Water Infiltration Gets the **1-2-3 PUNCH!** *with*

PRESSTITE'S Cold Applied 3-STEP SEWER SEALING SYSTEM

Sealing tight, dependable joints with Primer, Ropax and Kalktite on Lawrence job.

To knock out excessive ground water infiltration and protect against overloading the disposal plant, engineers at Lawrence, Ind., wanted tight, dependable sewer joints. That's why they specified Presstite's 3-Step Sewer Sealing System for 18 miles of new sewer lines serving 2000 homes.

Presstite's extensive research plus 30 years' manufacturing experience have resulted in development of the most effective, economical method to obtain tighter sewer joints:

1. Presstite Primer... a hard base asphaltic priming paint to first prime pipe bells and spigots.
2. Presstite ROPAX . . . non-porous packing that provides *additional* joint sealing material. When caulked back in the bell, it forms a solid seal, impervious to passage of water.
3. Presstite KALKTITE . . . cold mixed and applied joint sealing compound that sets up even under the most adverse conditions and forms a dense, tough and flexible seal that *stays* watertight.

For substantial savings in time and labor, too, you can't beat the Presstite System. Its fast, easy application allows installation of more joints per man, per hour, per day.

PRESSTITE SEALING COMPOUNDS

WRITE TODAY for samples and complete details on Presstite's cold applied 3-Step System for tighter, better sewer joints.

PRESSTITE ENGINEERING COMPANY

• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

A basic well-drilling item, the "Safe-Lok" Protector is a protective rubber bearing which is locked around drill pipe to reduce shock and wear inside the well casing. Installation and removal may be done by drilling crews without the use of special equipment.

The "Safe-Lok" Protector can be snapped on and off the pipe and used repeatedly.

Plastic Pipe

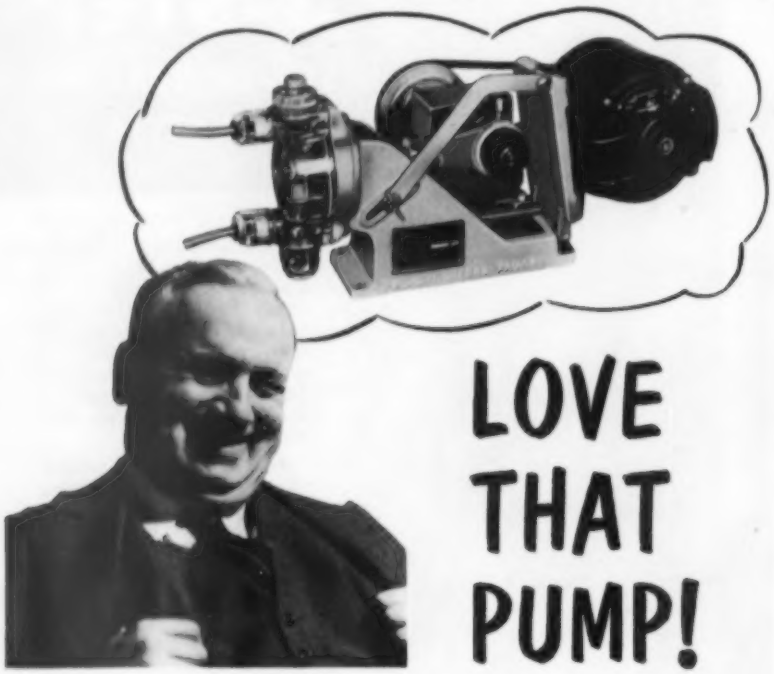
Chesflex Corporation, Yonkers, New York, has announced two new additions to its line of flexible polyethylene pipe. Ches-Twin Dual Pipe, consisting of two sizes of Chesflex Standard Pipe scientifically joined together, for jet well installations, and Chesflex Pressure Pipe for use in water systems of constant or variable pressures. The new pressure pipe, rated at 75 lbs. or 100 lbs., is reported to withstand intermittent short-duration surges of 3 to 4 times the continuous working pressure specified, thus providing an adequate safety factor.

The firm also announces the availability of a complete line of combination and metal fittings, in addition to its standard line of fittings for flexible pipe.

Weed And Brush Killer

Du Pont Company, Wilmington, Del., has announced a new, more concentrated, formulation of "Ammate" weed and brush killer. Identified as "Ammate" X, the new formulation contains 95 per cent of the active ingredient, ammonium sulfamate, instead of 80 per cent.

The new product will normally be used at the rate of 60 pounds per 100 gallons of water instead of 75 pounds. Containers for the new formulation will be 60-pound bags and 40-pound fiber drums, corresponding to the previous 75-pound and 50-pound containers.



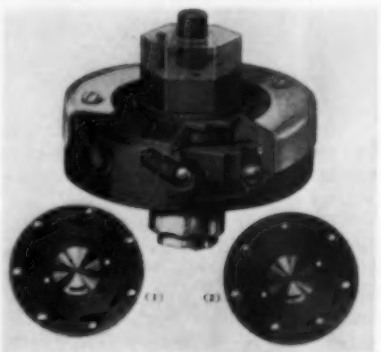
LOVE THAT PUMP!

There's a real feeling of relief to know Proportioneers "Little Red Pump" is in control of your water sterilization problems. Talk to any user of the Heavy Duty Midget Chlor-O-Feeder. He'll tell you about its low installation cost, its negligible maintenance cost, and its rugged dependability. He'll also talk about wide capacity range (up to 8.1 lbs. per hr. of chlorine using 15% Na O Cl) . . . and how easy it is to adjust feeding rate, or service this pump right on the job.

Want details on the pump you can "love" and trust? Send today for Bulletin 1201-1. Proportioneers, Inc., 350 Harris Avenue, Providence 1, Rhode Island.

PROPORTIONEERS
DIVISION OF B·I·F INDUSTRIES, INC.
BUILDERS IRON FOUNDRY • OMEGA MACHINE CO. • BUILDERS-PROVIDENCE, INC.
BIF METERS FEEDERS CONTROLS

Non-Reverse Ratchet Stops Backspin In Vertical Hollow-Shaft Pump Motor



ACEC Electric Corp., New York, N. Y., has announced that for positive protection against backspin, a ball-type, non-reverse ratchet in the new Acec Vertical Hollow-Shaft electric pump motor locks within 1/72 of a revolution and physically prevents the motor and pump from rotating in reverse.

The new "Bal-lok" non-reverse ratchet is now being offered on Acec Vertical Hollow-Shaft Motors of all sizes up to and including 200 horsepower.

Bel-lok's ratchet element is always stationary, while the ball retainer rotates with the motor. When the motor rotates in the proper—counter-clockwise—direction (1), centrifugal force lifts the balls clear of the ratchet so that they do not interfere with rotation. Once the motor stops (2), the balls drop back into the ratchet recesses. Should the motor begin to turn in the reverse—clockwise—direction, one or more balls will lock in the ratchet and prevent rotation. The entire assembly is mounted at the top of the motor for easy installation, inspection, and maintenance.

Multi-Function Control System

Builders-Providence, Inc., Providence, R. I., has announced the development of Synchro-Scan, a new Multi-Function Supervisory Control System.

This economical system, utilizing a single pair of signal wires and supervised by one operator, permits remote control of any combination of pumps, valves, gates, generators, circuit breakers, etc. from a central dispatching station. Synchro-Scan's components also accomplish two-way transmission of multiple telemetering and advisory functions thereby furnishing the operator with information to supervise all system operations and cope with almost any emergency.

Synchro-Scan Supervisory Control is designed for simple installation and maintenance by local electricians and station operators.

Among its advantages, this control system offers reduced cost through less man hours and leased telephone lines, increased dependability of operations, better quality service, and low cost system expansion because of "plug-in" unit construction. In addition to utilizing private or leased lines as transmission media, Synchro-Scan Supervisory Control transmits over audio tone channels, modulated carrier frequencies and microwave links.

Corrosion Resistant Primer

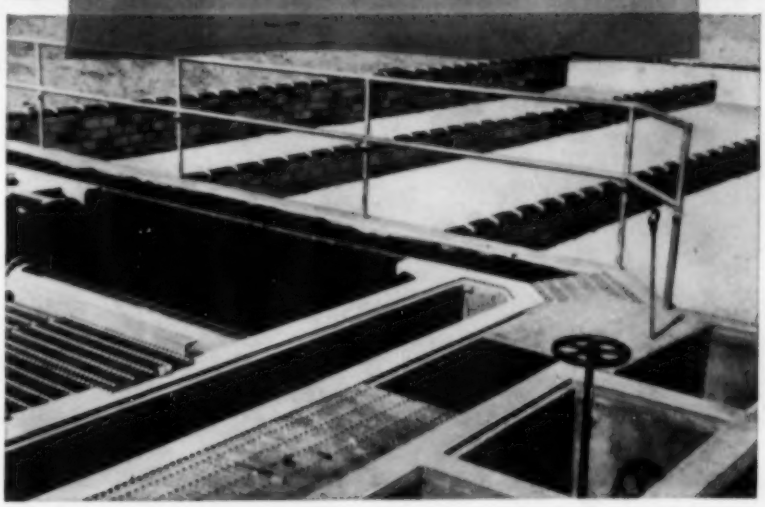
Pennsylvania Salt Manufacturing Company, Philadelphia, Pa., has developed LockPrime, a corrosion resistant liquid primer for new or corroded steel surfaces.

"Applied by brush or roller directly from the can," Sales Manager R. R. Pierce of the Corrosion Engineering Products Department explained, "LockPrime offers excellent resistance to under-cutting by corrosion when cover coats are damaged."

On either sandblasted new steel or wirebrushed rusted steel, LockPrime forms a tight adherent bond to the surface and provides excellent adhesion for following top coats of Pennsalt NeoCoat or Pennsalt Thickcoat. It is equally effective in acidic and organic atmospheres.

Applicable to all ferrous metal surfaces, tile red LockPrime contains 28% solids content by weight and covers 200 square feet per gallon per 1 mil coat. Since the bond strength of this primer actually increases with age, immediate application of top coat is unnecessary. As a basic component of the Pennsalt NeoCoat—Thickcoat system, LockPrime is now available in 1 gallon cans and 5 gallon drums.

Protected against sewage attack with BITUMASTIC® No. 50



Sludge drying beds in the Landis Township Sewage Disposal Plant, Vineland, N. J. Concrete areas are well protected against deterioration by Bitumastic No. 50.

It would be difficult to find forces that are more destructive than those encountered in modern sewage plants. Under the onslaughts of raw sewage and strong chemicals, concrete deteriorates quickly and metal soon corrodes unless the equipment is protected by *specialized* materials.

That is why Bitumastic No. 50—a *specialized* material—was selected to protect the concrete in these sludge drying beds. Bitumastic No. 50 is extra-thick. It is extra-tough. And it is specially formulated from a base of coal-tar pitch that is, for all practical purposes, impervious to water.

To control corrosion and deterioration, Koppers makes a family of cold and hot-applied protective coatings. Each coating is specially formulated to handle specific protection jobs. Write for complete information on how these durable coatings can give your sewage-plant equipment *lasting* protection.

Protection for Water Lines

Koppers makes hot-applied Bitumastic® Enamels that protect interior and exterior surfaces of large-diameter water lines against every corrosive force found underground. Write for free literature.

MADE ONLY BY KOPPERS

BITUMASTIC® PROTECTIVE COATINGS

SOLD THROUGH INDUSTRIAL DISTRIBUTORS

KOPPERS

KOPPERS COMPANY, INC.

Tar Products Division, Dept. 661-T, Pittsburgh 19, Pennsylvania

DISTRICT OFFICES: BOSTON, CHICAGO, LOS ANGELES, NEW YORK, PITTSBURGH, AND WOODWARD, ALA.

W&SW

Manufacturers' News

De Laval Plans Expansion In Trenton and Other Cities

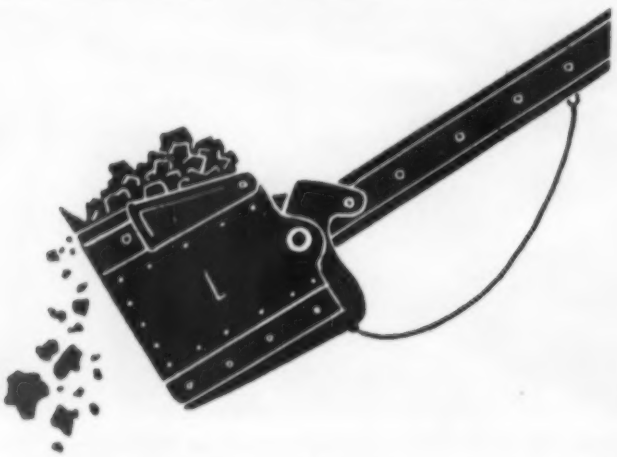
De Laval Steam Turbine Co., Trenton, N. J., has announced an extensive long-range expansion program. Under this program, land has been purchased for future construction of new buildings anticipated in Trenton, N. J., and Houston, Texas.

In Trenton, N. J., the company recently purchased 16.6 acres adjacent to the existing plants. A part of this area is already occupied by a building for the manufacture of high pressure turbochargers for diesel and gas engines.

Another new building has been planned for erection in Forrest Park, a rapidly growing industrial area near Chicago, Ill. It will be occupied by the sales and service division for De Laval's operations in the Midwest.

In Millbrae, California, near San Francisco, 2.6 acres have been purchased for a new plant of about 40,000 square feet. It is now under construction and is scheduled to be completed by August.

In Houston, Texas, 3 acres have been purchased to accommodate, eventually, a new building for the sales and service of De Laval products in the Southwest region.



for tomorrow's expansion *Call in National today!*

You can meet tomorrow's increased water demands with *clean water mains.* National is prepared to prove to you *how cleaning can effectively uprate your water system.*

Resultant higher pressures, increased volume and reduced pumping costs will prove that National Cleaning is an investment—not an expense.

Why not do as other leading cities have done—let *National* cleaning provide for tomorrow's expansion without capital expenditure today!

Remember, there's no obligation or cost for a thorough inspection by National engineers. Write us today!

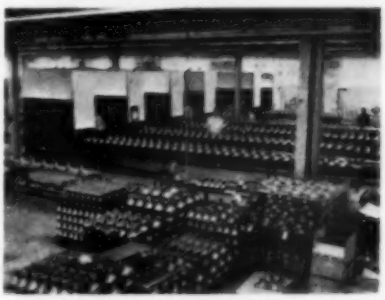
Call in National today!

NATIONAL WATER MAIN CLEANING COMPANY

50 Church Street • New York, N. Y.

ATLANTA, GA; 333 Candler Building • BERKELEY, CALIF; 905 Grayson Street • DECATUR, GA; P. O. Box 385 • BOSTON, MASS; 115 Peterboro Street • CHICAGO; 122 So. Michigan Avenue ERIE, PA; 439 E. 6th Street • FLANDREAU, S.D.; 315 N. Crescent Street • KANSAS CITY, MO; 406 Merchandise Mart and 2201 Grand Avenue • LITTLE FALLS, N.J.; BOX 91 • LOS ANGELES; 5075 Santa Fe Avenue • MINNEAPOLIS, MINN; 200 Lumber Exchange Building • RICHMOND, VA; 210 E. Franklin Street • SALT LAKE CITY; 149-151 W. Second South Street • SIGNAL MOUNTAIN, TENNESSEE; 204 Slayton Street • MONTREAL, CANADA; 2032 Union Avenue • WINNIPEG, CANADA; 576 Wall Street • HAVANA, CUBA; Lawrence H. Daniels, P.O. Box 531 • SAN JUAN, PUERTO RICO; Luis F. Caratini, Apartado 2184.

Rockwell Opens New Water Meter Plant



Rockwell Manufacturing Co., Pittsburgh, Pa., has opened its new 81,500-square-foot water meter plant in Uniontown, Pennsylvania.

The plant, now in full production, produces all of Rockwell's domestic water meters, sizes ranging from ⅝ inch to 1¼ inch outlet diameter.

A one-story brick-and-tile building, the new plant contains 56,200 square feet of actual manufacturing space and a 4,808-square-foot office area. The remaining 20,492 square feet consists of factory service space. The entire manufacturing area is laid out in such a way as to insure continuous flow from materials unloading docks at the front to storeroom to machine and assembly lines to testing lines to shipping department and, finally, to truck docks and railroad siding door at the rear.

Cottingham New President Of Henry Pratt Company

Henry Pratt Company, Chicago, Illinois, has announced that E. B. Cottingham was elected President of the Company. He succeeds Mr. S. B. Smith who was elected Chairman of the Board of Directors with Mr. W. S. Smith being Chairman of the Board Emeritus.

Mr. Cottingham, 47, has been Vice President in Charge of Production for Henry Pratt Company since 1950. He joined the company on April 15, 1925.

Other officers of the company include A. C. Johnson, Secretary and Treasurer; W. T. Herren, Vice President, Construction; W. J. Woolley, Vice President, Sales, and V. H. Haase, Assistant Secretary and Treasurer.

White Motor Company Acquires Engine Division Of National Supply Company

The White Motor Company of Cleveland, Ohio, has formally acquired the Engine Division of the National Supply Company in Springfield, Ohio. The transfer of property was made to facilitate the White Motor Company's entrance in the Diesel engine industry through the well-established and modern facility known throughout the world as the producer of Superior and Atlas engines. These are two of the oldest and internationally well-known names in the Diesel engine industry.

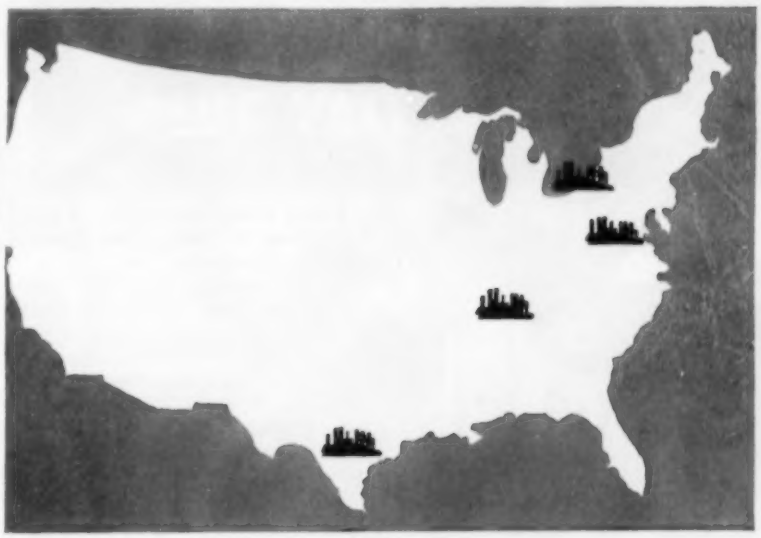
Robert F. Black, President of White Motor Company, also announced the appointment of William F. Burrows as General Manager of the newly acquired division which is to be known as the White Diesel Engine Division.

Lindquist Pump Changes Name, Moves Offices, and Opens New Warehouse

Lindquist Pump Corporation of Texas, formerly the Lindquist Pump Corp., has announced that the general sales offices and engineering department, formerly at

Chemicals you live by

Diamond Chlorine



QUICK DELIVERY FROM FOUR STRATEGICALLY LOCATED PLANTS

When you are looking for a reliable, long-term source of supply for chlorine, call DIAMOND ALKALI. We have four modern plants strategically located to serve major chlorine-consuming areas.

These plants ship in all standard-size containers, including 150-lb. cylinders, ton containers and single-unit tank cars. Shipments can be by rail, truck, and in some cases by water. For information and technical assistance on chlorine application and safe handling, call your nearby DIAMOND Sales Office or write DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

DIAMOND ALKALI CHEMICALS

Diamond Chemicals

CHLORINE PLANTS: Edgewood, Md.—Muscle Shoals, Ala.—Painesville, Ohio—Houston, Texas.

SALES OFFICES: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis, and Houston.

More Popular Every Day...

Leopold

Glazed Fire Clay

Tile Filter Bottoms

During 1954 more Leopold duplex filter bottoms were sold than in any previous year in our history. To date, there are well over 300 plants (with a daily capacity in excess of 1½ billion gallons) that have selected Leopold bottoms—including such major municipal installations as Phoenix, Arizona; Houston, Texas; Trenton, New Jersey; Detroit, Michigan; Baltimore, Maryland; Columbus, Ohio; Kansas City, Missouri; Omaha, Nebraska; and Philadelphia, Pennsylvania. Represented in this group are the five largest municipal filter plants under construction in the country at this time.

There are, of course, good reasons why the Leopold Glazed Tile Filter Bottom is getting more popular every day. In this design, laterals and distributing blocks are combined in one permanent unit that insures equal distribution and uniform filtration. The individual blocks are made of de-aired fire clay, vitrified and salt glazed. They resist corrosion, are not subject to tuberculation, won't absorb any detrimental amount of water, are impervious to acids and alkalis, and will last indefinitely.

If you're looking for a practical, economical solution to your underdrain problems, consider the advantages offered by Leopold. We'll be glad to supply details—without obligation.

Look to Leopold for complete water purification and sewage plant equipment...

• Dry Chemical Feeders • Mixing Equipment
• Filter Operating Tables • Filter Bottoms

Write today for details

F. B. Leopold Co., Inc.
2413 W. Carson Street
Pittsburgh 4, Pa.

10001 W. Jefferson Blvd., Culver City, Calif., are now located at 2207 Border Street, Torrance 3, Calif.

It was also announced that a new Southwest warehouse for the company has been set up at 3110 Lone Field Drive, Dallas, Texas. New distributors for the Southwest include: Western Pump Distributors, Lubbock, Texas; Alliger & Sears, Houston, Texas; Layne-Louisiana Co., Lake Charles, Louisiana.

Personnel Appointments At Enterprise Engine

Enterprise Engine & Machinery Co., San Francisco, Calif., has announced the appointment of Mr. L. C. Michie as Manager of the St. Louis District and Mr. Robert M. Pearson as Field Sales Manager for the Company.

Mr. Michie will direct the company's sales and service activities out of the St. Louis District. He was associated with Baldwin Locomotive Works diesel service division for 10 years, and with Fairbanks-Morse for 10 years as a Service Supervisor and diesel engine Sales Engineer. L. J. "Dutch" Robbins will continue as the Enterprise Service Engineer in the St. Louis District.

Mr. Pearson has been active in the diesel engine industry for 30 years, the past 12 with the National Supply Company as manager of sales. He was previously identified with Fairbanks, Morse & Co., General Motors Corp., and prior to that was engaged in engineering work in heavy industry in Pittsburgh.

Means Appointed General Mgr. By Koppers Tar Products Div.

Koppers Company, Inc., Pittsburgh, Pa., has announced the appointment of K. D. Means, former manager of the Division's planning department, to the office of General Manager.

Mr. Means, an Assistant Vice President and a veteran of 40 years service with Koppers, was graduated from Cornell University with a degree in Mechanical engineering. During his long association with Koppers, he has held a variety of administrative positions.

Woodland Appointed General Sales Manager at Chain Belt

Chain Belt Company, Milwaukee, Wis., has announced that

In hydrants, too, it's important to have

Unobstructed flow

Look at a cutaway view before you buy any hydrant! You'll be surprised how few provide an absolutely unobstructed waterway! And *no one* but Iowa offers you *all* this and much more—

1. Provides full and unobstructed waterway for maximum flow from main to nozzle.
2. All internal working parts removable through top, for periodic inspection.

3. Superintendents find Iowa hydrants easy to keep in "tip-top" operating condition—no special tools required.
4. Main valve holds tight in closed position so that—should hydrant be damaged—no loss of water, or flooding, will occur.
5. Two-piece operating nut eliminates binding or distortion of working parts (sometimes caused by expansion and contraction) — makes Iowa hydrants easy to open and close at all times.
6. Complete drainage by sure acting drain, prevents freezing.
7. Fully bronze mounted throughout—meet all requirements of A.W.W.A. —have proved their ruggedness and reliability to waterworks men everywhere.
8. Available with any type of connection.

Get ALL the facts! Write

IOWA
VALVE COMPANY
Oskaloosa, Iowa
A subsidiary of James B. Clow & Sons

George H. Woodland has been appointed to the newly created position of General Sales Manager, Industrial Divisions. Mr. Woodland joined Chain Belt Company in 1938, taking a student training course. Following that he has held various positions of responsibility in sales, most recently as Manager of Industrial Field Forces. This continues to be a part of his new responsibilities which include General Sales Distribution Policies, for the Industrial Divisions of the company.

B-I-F Promotes Strickland To Chicago

B-I-F Industries, Inc., Providence, R. I., has announced the promotion of M. H. Strickland to Manager of Industrial Sales, Chicago District, handling the products of Builders - Providence, Inc., Proportioneers, Inc., and Omega Machine Co., all Divisions of B-I-F Industries, Inc.

Born in Manchester, Connecticut, Mr. Strickland attended Manchester High School and was graduated from Wesleyan University in 1922.

Since March, 1936, Mr. Strickland has been the St. Louis representative for Builders-Providence, Inc., and Proportioneers, Inc. He will now also represent Omega Machine Co.

Patterson Appointed Advertising Manager by Fischer & Porter

Fischer & Porter Co., Hatboro, Pa., has announced that Thomas A. Patterson, Jr., formerly an account executive with the Ketchum, MacLeod & Grove advertising agency, Pittsburgh, has been appointed advertising manager.

A native of Houston, Texas, Patterson studied at Rice Institute, was an instructor in the Naval Radar School at the University of Houston and served in the Air Corps as an airborne radio operator for two years.

In 1947, Patterson went into advertising and sales promotion with the RCA Tube Department in Harrison, N. J. Three years later he became associated with Sylvania Electric Products Incorporated

No. 3* of . . .

12 REASONS WHY
YOU SHOULD BUY AND USE
LOW-PRICED

HOMESTEAD
Lubricated
PLUG VALVES
Pat. Pending

Insist on 100% pipe area **HOMESTEAD LUBRICATED PLUG VALVES** to avoid costly pressure losses. If a slight restriction is unimportant, worthwhile savings can be made by using our Venturi type valve.

Your choice of ports is only **ONE REASON WHY** you should buy and use, *low priced* **HOMESTEAD LUBRICATED PLUG VALVES.**

HERE ARE ALL TWELVE

1. Reinforced Teflon packing ring.
2. Completely controlled high-pressure lubricant system.
3. 100% pipe area and venturi patterns.
4. No spring torsional stress.
5. No mechanical adjustments.
6. Two lubricants handle most services.
7. Extremely close tolerance between sealing surfaces.
8. Triple head-seal with Lubricant and Teflon packing ring.
9. Plug floated on Teflon surfaces.
10. Leak-proof, double-ball-and-lubricant-sealed check valve.
11. Full-threaded screw assures clean lubricant.
12. Extruded lubricant shows a full protecting system.

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in its tube division at Emporium, Pa., as senior engineer supervising the technical publications section. Patterson joined Ketchum, MacLeod & Grove in 1952.

Earl Elected Director of U. S. Pipe

United States Pipe and Foundry Company, Birmingham, Ala., has announced that Lloyd R. Earl has been elected a Director of the Company.

Mr. Earl started his business career as a machinist and worked up through the ranks of Consolidated Steel Corp., to Vice President of Operations, a member of the Board and of the Executive Committee and to Vice President and Director of Consolidated Western Steel Corp.

Since 1952 Mr. Earl has been President and a Director of United Concrete Pipe Corporation of California, a wholly-owned subsidiary of United States Pipe and Foundry Co.

Baer Promoted at S. Morgan Smith Co.

S. Morgan Smith Company, York, Pennsylvania, has announced that George A. Baer has been named Application Engineer in the Valve Sales Division. Baer, who joined the company in 1947, had worked in both the turbine design and valve design departments before being assigned to his new job by Carl J. Wilcox, manager of the company's Valve Sales Division.

Rumely Retires From Crane Co.

Crane Co., Chicago, Ill., has announced the retirement of Vincent P. Rumely, senior vice president and member of the board of directors.

Mr. Rumely became associated with Crane Co. in 1937 as a production engineer. Previously he had served with the Buick and Hudson Motor Car Companies.

He was named manager of Crane's Chicago Works in 1938. Three years later he was elected vice president of manufacturing, and was named senior vice president of manufacturing in 1953.

Hughes to Head Reilly Dallas Office

Reilly Tar & Chemical Corporation, Indianapolis, Indiana, has announced that Henry D. Hughes has been placed in charge of the Reilly sales office in Dallas, Texas.

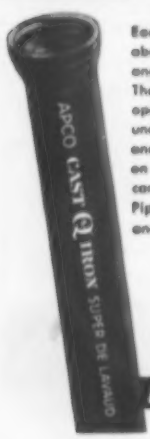
A native of Dallas, Mr. Hughes was educated at local schools, Texas A & M, and Southern Methodist University where he graduated from the School of Business Administration and attended the School of Law. Prior to the completion of his education, Mr. Hughes served, during World War II, with the U. S. Marine Corps in the South Pacific and was enrolled in Officer's Candidate School at the time of his discharge.

Henry Hughes has been engaged in the water and sewage construction business and has been associated with the Farquar Company. Prior to joining Reilly, he was managing his own oil and gas producing and operating organization.

Mr. Hughes will have his headquarters in the new Reilly offices at 520 Park Avenue, Dallas 1, Texas.

F. D. Brown Joins Gorman-Rupp

Gorman-Rupp Company, Mansfield, Ohio, has announced that Mr. Ford D. Brown has been named Eastern Representative for the company. Mr. Brown brings



Each length of pipe we manufacture passes through the above hydrostatic test press where it is filled with water and the pressure raised to 500 pounds per square inch. The most common water works pipe is designed for an operating pressure of 150 pounds per square inch. This undergoes the 500 pounds per square inch hydrostatic test and permanent records for each piece of pipe are kept on file for inspection by our customers at all time. You can be assured with Alabama's Super De Lavaud Cast Iron Pipe. In sizes of 3" to 24" in modern long lengths. Bell and Spigot, Mechanical Joint and Flanged Pipe.

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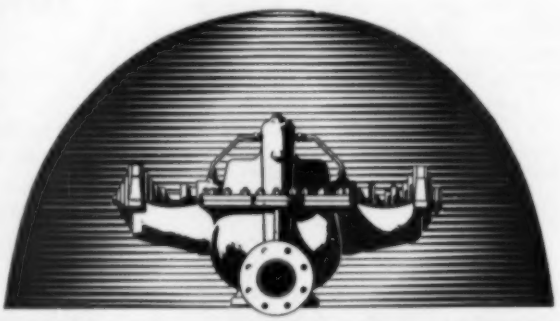
350 Fifth Avenue New York 1, New York

ALABAMA PIPE COMPANY
ANNISTON ALABAMA



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For: Water Supply, Sewage and Waste Disposal, Boosting, Fire Protection, Cooling Tower and Process Services.

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Write for descriptive Bulletin on type you require.

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Food Machinery and Chemical Corp.
Factories: Los Angeles, Cal.; Indianapolis, Ind.
Offices: New York; Chicago, St. Louis; Atlanta; Phoenix; Dallas, Plainview and Lubbock, Texas; Fresno; Los Angeles; Albuquerque.

PEERLESS BUILDS DEPENDABLE PUMPS

with him over fifteen years experience in the pump industry, having been associated with such firms as Bowser, Inc., Blackmer Pump Co. and Eco Engineering Co. Metropolitan New York through Eastern Virginia is the area to be covered by Mr. Brown.

Graver Appoints Crell

Graver Water Conditioning Co., New York, N. Y., has announced the appointment of J. D. Crell as Sales Engineer for the New York City Sales District.

Mr. Crell will work out of the New York Office at 216 West 14th Street. He has been with Graver for several years and is completely familiar with all phases of Industrial, Municipal and Industrial Waste Treatment.

Dengler Joins Beaver Pipe Tools

Beaver Pipe Tools, Inc., Warren, Ohio, has announced that Mr. Ned Dengler, formerly associated with the Sales Division of Bingham-Herbrand Corporation, Fremont, Ohio, has been appointed District Manager of Sales for the company.

Dengler's territory will include Southern Ohio, Indiana, West Virginia and Kentucky. He will contact Beaver distributors and users in that area. He will base his operations at Fremont, Ohio. He succeeds the late Al Thornton, Jr.

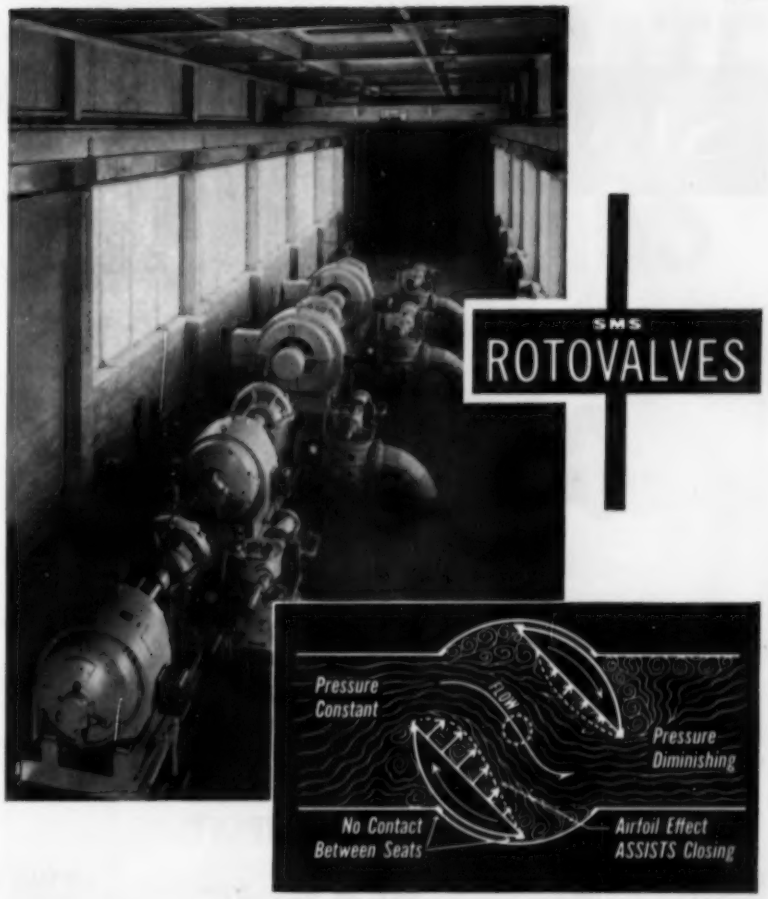
Graver Appoints New Sales Representative

Graver Water Conditioning Co., New York, N. Y., has announced the appointment of the Allen-Shuff Corporation of Memphis and Nashville as sales representatives. Their territory will include all of eastern Arkansas, northern Mississippi and western Tennessee from the Tennessee to Mississippi Rivers.

Allen-Shuff will handle Graver's complete line of Industrial, Municipal and Industrial Waste treatment equipment.

Messrs. W. Harwell Allen, Vice-President and General Manager, Charles F. Almand, Memphis Branch Manager, and Stephen J. Wilkie, Sales Engineer, bring to Graver a background of experience in the power plant and water conditioning field that will be of value both to the organization and to its customers.

Allen-Shuff is located at 1121 Church St., Nashville 3, Tenn.



Hydraulic Imbalance Makes SMS-Rotovalves

EASY TO OPERATE.

SMS-Rotovalves are easier to open and close. As shown in the diagram, hydraulic imbalance effects an airfoil on the valve's inner surface to assist closing. The conical plug first lifts, then turns on bronze trunnions to eliminate friction and wear on seats, finally reseats. This eliminates the causes of failure and breakage.

Because SMS-Rotovalves need less effort to operate, one man can handle manual opening or closing. In electric operation, smaller motors can be used without increasing operating time. Hydraulic or pneumatic operation requires smaller cylinders and less pressure.

These exceptional performance characteristics are the results of over 75 years of hydraulic research and engineering. For detailed information on our complete line of Rotovalves, Ball and Butterfly valves, see our local representative, or write to the S. Morgan Smith Company, York, Pennsylvania.

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Accessories

HYDRODYNAMICS

Rotovalves
Ball Valves
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Free-Discharge Valves
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SMS S. MORGAN SMITH CO.

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

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WATER CONTROL EQUIPMENT

SPARLING METROVALVES

Measure the Quantity—Regulate the Rate

The Sparling Main-Line Meter combines with a Sparling Hydrovalve and electric Telechron Motor to regulate or terminate the flow at any set point on the Selector scale. Built in all meter sizes from 4-inch up to 16-inch.

Write for Form 575

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Box 3277.....LOS ANGELES 54
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. . . give these outstanding plants—corrosion free construction • uniform flow distribution • low head loss.

CLEVELAND, OHIO (Havens & Emerson, Engrs.)
NASHVILLE, TENN. (The Chester Engineers)
MIAMI, FLA. (Day & Zimmerman, Inc., Engrs.)
WILMINGTON, DEL. (Metcalf & Eddy, Engrs.)

For details on monolithic and pre-cast Wheeler Bottoms, write Builders-Providence, Inc., 350 Harris Avenue, Providence 1, Rhode Island.

BUILDERS-PROVIDENCE
DIVISION OF B-I-F INDUSTRIES, INC.
BUILDERS IRON FOUNDRY • PROPORTIONERS, INC. • OMEGA MACHINE CO.
METERS FEEDERS CONTROLS

Literature & Catalogs

Stock Instrument Program

Fischer & Porter Co., Hatboro, Pa., has announced that process control instruments standardized and stocked for immediate shipment from Hatboro, Pennsylvania; Chicago, Illinois; Houston, Texas; and Los Angeles, California, are described and illustrated in the company's new 24-page Catalog.

Complete specifications include dimensions, prices, capacities and construction materials on Fischer & Porter's complete line of **Standardized Process Control Instruments.** The catalog also includes sizing nomographs, panel mounting diagrams, safe working pressure tables and basic operating data for the instruments described.

Color Booklet Features New U. S. Motor

U. S. Electrical Motors, Inc., has just published a multi-color 12-page booklet illustrating the numerous revolutionary features of the all-new **U. S. Type H Uniclosed Motor.** Cut-open views of the improved motor, illustrating its various constructional features, are shown in full color. By increasing precision of manufacturing processes, with tolerances to closer limits and improved electrical characteristics, the new Type H is more compact than previous models. An outstanding feature is its new fully protected design.

A series of colorful drawings with call-outs show how a uniquely designed part termed the Ventrifoil at both air intakes of the motor protects the interior. The end brackets are of an entirely new design with air intakes so arranged as to prevent intrusion of water or dust yet allow liberal air flow into the motor for 2-way ventilation. The Ventrifoil prevents splashings from entering and coming in contact with the windings.

Pneumatic Flow Meters

Builders-Providence, Inc., Division of B-I-F Industries, Inc., has issued a four page color bulletin on its complete line of **"Pneumatic**

Flow Meters" for providing the accurate, dependable flow metering required for efficient operation of today's water and sewage plants.

This bulletin contains photos and diagrams of typical installations in the field together with sections containing valuable information on the description, advantages, and operation of transmitters, large dial gauges, summation units, and controlled automatic proportional pacing.

Some of the advantages of Builders flow metering equipment include simple, flexible installation, consistent accuracy under low and high head, mechanical simplicity, sturdy construction and sound engineering design.

Rotary Blowers

Miehle-Dexter Supercharger Division of the Dexter Folder Company, Racine, Wisconsin, has just released a new six page bulletin, showing the versatility of application for **Miehle-Dexter Blowers.**

Several new applications for blowers are illustrated and described. The bulletin also reviews the application of these blowers as superchargers and scavenging blowers.

Also illustrated and described are the newly developed Tandem Blowers and Motorized Blowers. A special section of the folder also describes the several exclusive construction features of the Miehle-Dexter Blowers.

A simple table and graphs are included in the folder, making it easy to determine the proper size unit to be used on various applications.

Oxygen Analyzer Bulletin

Arnold O. Beckman, Inc., South Pasadena, Calif., has just published an informative new bulletin describing their Model C and Model C2P **Oxygen Analyzers.**

According to the bulletin the Model C Analyzer is a simple convenient, low-cost instrument that can be used for measuring the oxygen content of either continuously-flowing gas samples or fixed volume samples as small as 3 cc. With either type of sample the oxygen content is read directly from a translucent scale, without use of catalysts, filaments, chemicals, or complicated mechanical hook-ups.

The bulletin points out that the Model C2P is similar to the Model

HOW TO LOCATE WATER LEAKS

...with Simplex Pitot Equipment

WHY not decrease your load and stop pumping to waste? Locate the hidden leaks which waste thousands of gallons per day per mile of main . . . far more than usually guess-timated!

Locating these leaks with Simplex Pitot Equipment costs only a tiny fraction of the value of the water being wasted. You get accurate flow records with minimum effort . . . valuable data that will help you to reduce "unaccounted-for water" to a minimum.

PITOT ROD

Simple, rugged and lightweight. Easily installed on any pipe or main. Special clamp holds tube firmly in position against water pressure.

Low coefficient gives high differential pressure for greatest accuracy.

MANOMETER

Quickly connects to a Simplex Pitot Rod with flexible tubing. You then have a simple, sensitive and inexpensive instrument for indicating rate of flow.

Can be used for wide flow ranges . . . low or high.

PITOT RECORDER

Connects easily to Pitot Rod. Eight-inch chart records flow data. Simple and rugged construction . . . no delicate mechanisms...yet sensitive and accurate.

Sturdy carrying case. Leveling feet. Reliable 7-day clock movement for chart. Accurately calibrated.

Get the Facts!

Free 20-page Technical Bulletin 1300. Full instructions for use and care of Pitot equipment. Seven pages of helpful formulae, tables, curves. Write to

Simplex Valve & Meter Co.
Dept. WS-6, 7 E. Orange St., Lancaster, Pa.

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VALVE AND METER COMPANY

BALDWIN ALUMINA SET

For quickly determining the residual alum in filtered water. The complete apparatus includes reagents, color standards and portable hardwood carrying case. The case protects the apparatus from possible contamination with alum dust. Complete with directions for use.

82-760 ..... Each $65.00

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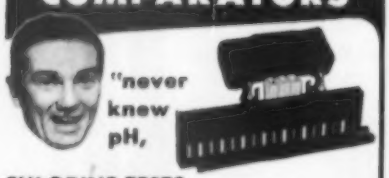
TAYLOR COMPARATORS



"never knew pH, CHLORINE TESTS could be so easy!"

You can make pH, chlorine or bromine determinations in a matter of seconds by only three simple steps with Taylor Comparators. Complete water analysis, including fluorides, is only a little more detailed when you use a Taylor Water Analyzer. Taylor sets are lightweight, durable, portable. Many different tests can be made on a single base. Best of all . . .

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SEE YOUR DEALER for Taylor sets or write direct for FREE HANDBOOK, "Modern pH and Chlorine Control". Gives theory and application of pH and chlorine control. Illustrates and describes full Taylor line.

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C, except that—for convenient use in the field, plant, or laboratory—it incorporates added features to increase its portability.

Swimming Pool Water

Olin Mathieson Chemical Corporation, Baltimore, Md., has available an up-to-date manual, useful to swimming pool operators, entitled **"Purification of Swimming Pool Water."**

The 64-page book, bound in heavy leatherette, discusses numerous problems of purifying and safeguarding swimming pool water. It is well illustrated with charts, drawings and tables. Some of the information presented, such as the chart showing average normal daily chlorine requirements, is not thought to be available from any other sources. The book also contains data on typical chlorine residuals versus time curves and suggests and discusses numerous methods of installing the HTH Tablet Hypochlorinator on all types of pools.

Condensed Valve Bulletin

Schutte and Koerting Company, Cornwells Heights, Pa., has just published a new **Valve Bulletin V-1** that is designed to show engineers, in the briefest possible way, some of the current valve types manufactured by the company.

The bulletin illustrates and describes SK's line of Bleeder Check, Boiler Feedwater, Venturi Reducing, Heater Bypass, Balanced Butterfly, and Atmospheric Relief Valves and a new High Pressure, Forged Strainer.

It includes information on SK designs and their specific advantages and data on construction and application. SK's quality control and testing facilities are also described.

Pump Bulletin

C. H. Wheeler Manufacturing Co., Economy Pumps Division, Philadelphia, Pa., has just published a bulletin that describes **Wheeler-Economy Two-Stage Type DMD Pumps.** Construction features are illustrated, including dimension tables for various pump sizes. Wheeler-Economy Type DMD two-stage pumps find general acceptance in high head water works, buildings, hydraulic elevators, oil refineries, mines, chemical

NOW!
A Guaranteed Anti-Algae

BERKITE No. 13

Prevents slimy algae in ponds, swimming pools, lakes and cooling towers!

BERKITE No. 13 is a revolutionary, new anti-algae which destroys algae spores before they develop; *destroys* even heavy, slimy algae growth *fast . . . economically!* Tests show that when used as directed one gallon treats a million gallons of water; remains effective for a month or more and won't harm fish, birds, domestic animals or swimmers! Developed by Modern . . . leading manufacturers of pool supplies since 1935. Order now! Case of 4 gallons $48.00. Single gallon $12.50.

Write for FREE 1955 Catalog and Data Book No. 15-F. Describes latest water-treatment chemicals and pool supplies.

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SWIMMING POOL CO., INC.
ONE HOLLAND AVENUE
WHITE PLAINS, N. Y.

REPAIR BROKEN MAINS

SKINNER-SEAL Split Coupling Clamp for dependable and lasting repair of broken mains. Sizes 2" to 24" inclusive. Write for catalog.

M. B. SKINNER COMPANY
SOUTH BEND, INDIANA

plants, boiler feeding and many other allied fields where head requirements exceed single stage pump capabilities. Designed in sizes from 2″ to 10″ discharge for capacities to 4000 GPM and for heads to 750 feet, they are highly efficient, compact, rugged and serviceable units which will meet the most exacting specifications.

Walsh Holyoke Catalog

Walsh Holyoke Div., Continental Copper & Steel Industries, Inc., Perth Amboy, New Jersey, has just published a new **Walsh Holyoke Catalog.** Walsh is one of the three integrated CCS components that form the Metals Fabricating Divisions of that corporation.

Documented by many step-by-step photographs, the new Walsh catalog takes the reader through the extensive Walsh facilities located at Holyoke, Mass., and So. Portland, Maine. The manufacturing processes performed and the equipment housed in these plants are described and explained in detail as the reader follows products ranging from penstocks to snow plows through complete production cycles. In addition, the catalog contains many photographs of Walsh finished products, a chart of standard available pipe sizes and weights, and a detailed listing of Walsh services.

Sanitary Cleaner Bulletin

Gorman-Rupp Company, Mansfield, Ohio, has just published a bulletin that contains a wealth of information on modern septic cleaning. The new bulletin describes Gorman-Rupp's **Odorless Sanitary Cleaner** and is useful to sanitarians, operators, municipal and health officials. Along with unit specifications on the new Model 201-A O.S.C., a picture story presents typical applications.

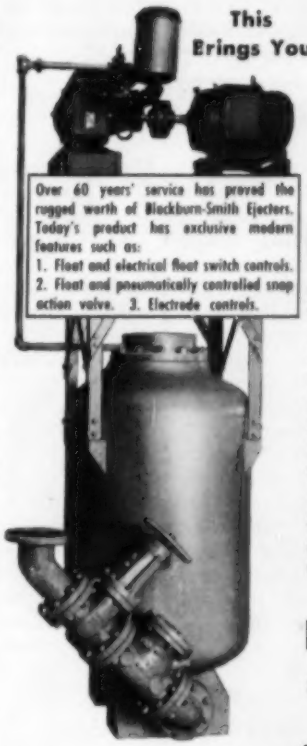
Filter Plant Gauges

Simplex Valve & Meter Company, Lancaster, Pa., has just prepared a bulletin that features its new line of **Filter Plant Gauges.** These units can be utilized for the measurement of effluent flow, loss of head, wash water, water elevation and percent of filter bed expansion.

Throughout its 20 pages, the bulletin describes the various types of meters and includes facts on oper-

LOOK!

This Brings You


Over 60 years' service has proved the rugged worth of Blackburn-Smith Ejectors. Today's product has exclusive modern features such as:
1. Float and electrical float switch controls.
2. Float and pneumatically controlled snap action valve. 3. Electrode controls.

Blackburn-Smith Mfg. Co.
55 Garden Street, Hoboken, N. J.
I want to know how I can get better sewage ejection at lower cost.
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Company.....
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BETTER, LOW COST SEWAGE EJECTION

If you want to get rid of complex piping, to eliminate screens, impellers, shredders, with their clogging and constant costly pump cleaning . . . send the above coupon for our Engineering Bulletin S50. If you want to lift sewage 150 feet at 90 to 500 g.p.m. without failure or mess or big bills . . . you'll want the facts in this Bulletin. Blackburn-Smith Sewage Ejectors in single and twin units are rugged, more economical and sanitary. Their reputation for dependable service is unsurpassed.

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Consulting Engineers: Burns and McDonnell, Kansas City and Cleveland; General Contractor: Interstate Corporation, Kansas City; Mechanical Sub-Contractor: Jacobson Plumbing & Heating Company, Kansas City

These DeZurik Non-Lubricated Plug Valves are installed in the settling basin sludge draw-off lines of the Kansas City, Missouri, Water Works.

They're an up-to-date choice, too! DeZurik Valves seal tight despite sand, silt or sludge in the flow. Their rubber-faced plugs and exclusive eccentric action insure drip-tight closure every time. Write for complete details.

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Switch to
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Trade Mark Reg. U.S. Pat. Off.
the modern, all-purpose filtering medium
BEST for every type of filter
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Surer Gland Lubrication for Centrifugal Pumps
THE Z-F GREASE SEAL
Eliminates that trouble spot where shaft enters casing. Applies constant positive lubrication to packing and shaft—automatically. Excessive heat, rapid wear, leakage and scoring will disappear as the Grease Seal applies a constant flow of lubrication when pump starts until it stops—automatically. Many other advantages, too. Write for complete description and price.
ZIMMER and FRANCESCON
MOLINE, ILLINOIS

ation, construction, general information, sizes and capacities, specifications and other pertinent data of interest to consulting plant engineers, purchasing engineers and plant operating personnel.

Electrifugal Pump Bulletin

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just published a bulletin on the Model C-3 supporting adapter **"Electrifugal" Pumps.**

The units are available in capacities to 2500 gpm, heads to 400 ft and temperatures to 250 F.

Pump types described include those having a casing with removable suction cover and those having a casing with suction and discharge nozzles in one piece.

Alternate sealing arrangements available originally or possible as field modification without affecting any major parts are also described in the bulletin. These include an external seal, an external grease seal, a single inside mechanical seal, and a double inside mechanical seal.

New Two-Piece Filter Block

Straitsville Brick Co., New Straitsville, Ohio, has just published a completely illustrated bulletin describing **Ceramifilter,** a newly designed two-piece filter block that completely eliminates hand placement of filter stone.

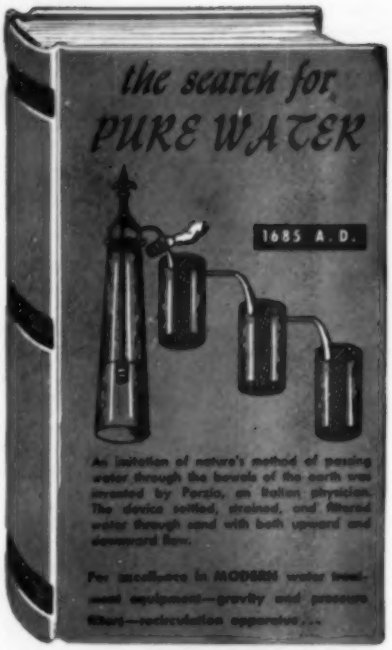
According to the bulletin, this new, two-piece block provides larger run-off channels and aeration openings at no extra cost, clean channels and eliminates hand placement. The cost of Ceramifilter floors, in place and covered, is no greater than ordinary one-piece filter block floors that require hand placement of filter media.

Two New Bulletins on Water, Sewage & Waste Equipment

Walker Process Equipment Inc., Aurora, Illinois, has just published two new bulletins, covering items in their line of **Water, Industrial Waste and Sewage Treatment Equipment.**

Bulletin 9W65 presents a complete picture of Walker Circular Collectors including Tractor Drive units, Pier supported and Bridge supported mechanisms.

Details on Diffusair aeration equipment are given in bulletin



MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.
ROBERTS FILTER MFG. CO.
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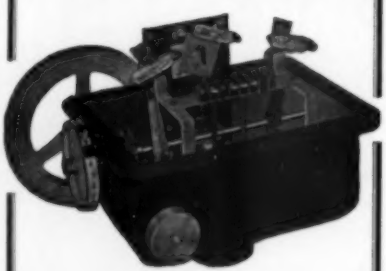
Darby, Pa.

ROTO-TROL

RF-2
WITH ALTO-TROL
This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles. The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.
Write for full data
WATER LEVEL CONTROLS DIVISION
HEALY-RUFF COMPANY
783 HAMPDEN AVE., ST. PAUL 4, MINN.

22S61. Applications of the equipment include activated sludge aeration, aerobic digestion, CO_2 diffusion, pre-aeration and others.

Consulting engineers and others concerned with the design and selection of equipment for municipalities and industry will find these bulletins helpful.

Controller Bulletin

The Foxboro Company, Foxboro, Mass., has just published a new 12-page bulletin that describes in detail the company's new Model 41A **Pneumatic Indicating Controller,** for control of process variables such as temperature, pressure, liquid level and humidity.

New design features are fully explained, with emphasis on the longer, more readable indicating scale, extensive use of high quality control components, and simplified maintenance.

In addition to on-off control, the new instrument provides proportioning action adjustable from ¼ of 1% to 25% of scale range, extending its field of industrial process application. The new proportioning mechanism is diagrammed and explained; typical applications are shown.

Separate sections are devoted to temperature and pressure measuring systems, with information on the filled thermal systems available, temperature bulbs and accessories, new pressure elements, pressure seals and control valves.

Complete controller specifications are also presented in the new bulletin.

Incineration Plants

Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa., has just published a new 24-page brochure that describes the company's **Incineration Plants** for the modern municipality.

In addition to descriptive data on the various types of municipal incineration plants offered by the company, the brochure features the mechanical stoking system available for new and existing PDM plants. Considerable background material on municipal refuse disposal is presented.

Including more than 40 photographs, engineering drawings and sectional views, this brochure also presents data on sludge incineration and modernized or enlarged Pittsburgh-Des Moines Incineration Plants.

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B-I-F Industries, Inc., Providence, R. I., has available a reprinted article by Lawrence Lowy, of the company, entitled **"What's Available Today for Automatically Proportioning Liquids and Solids."**

It is divided into two parts, one dealing with automatic proportioning of liquids and the other with solids. There are a number of clear easy-to-read diagrams, tables, and typical installation drawings provided in this helpful and informative article.

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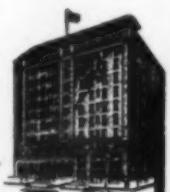

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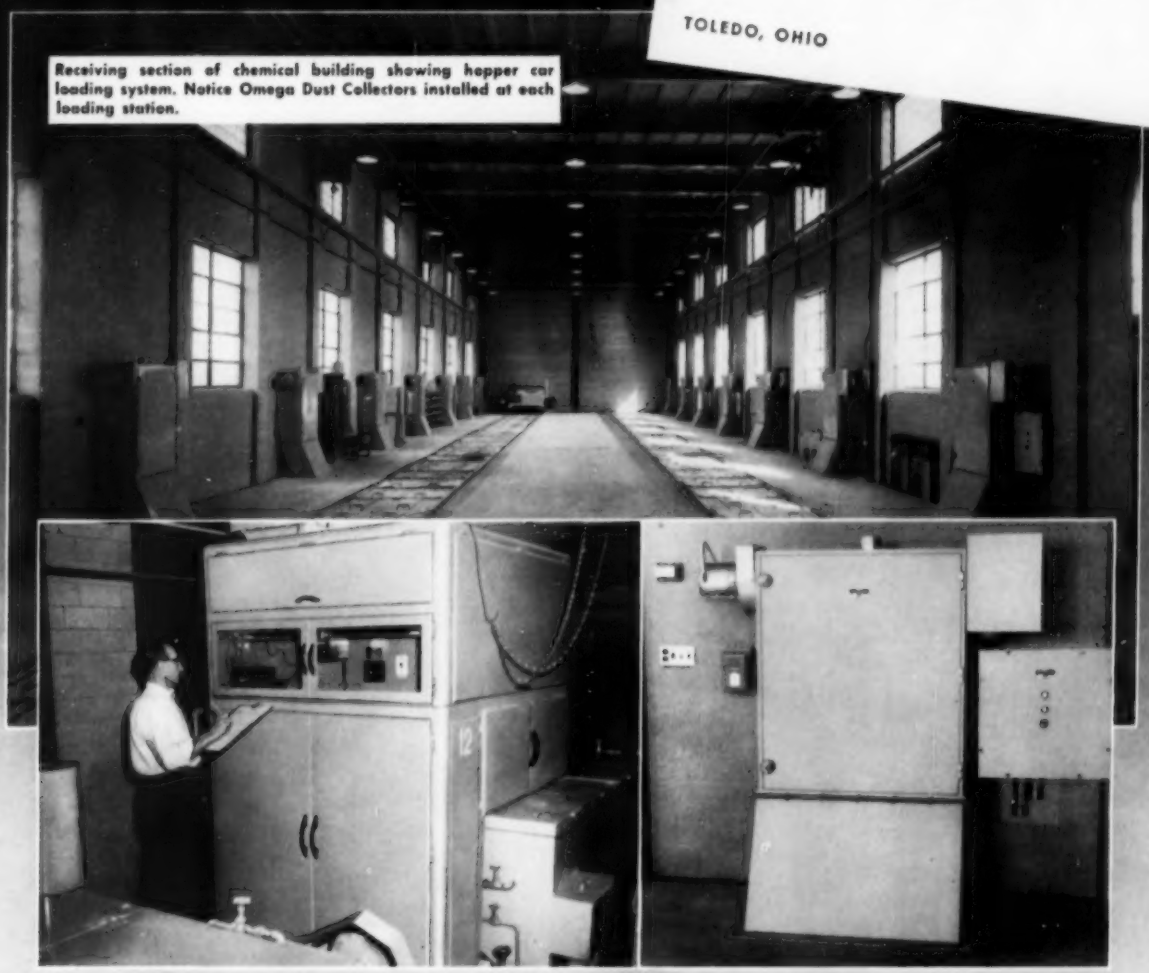

Receiving section of chemical building showing hopper car loading system. Notice Omega Dust Collectors installed at each loading station.

Omega Model GLW-2 Loss-in-Weight Gravimetric Feeder with Lime Slaker. This type of feeder was chosen in order to gain maximum accuracy of chemical feed control.

Close-up of Omega Dust Collector with its unitized motor control. Dust Collector is operated only during chemical loading periods.

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Very truly yours,

Clyde R. Harvill

Clyde R. Harvill
Superintendent
San Jacinto Water System

W&T WATER DIAPHRAGM EQUIPMENT

"...has stood the test of time..."

At Houston's San Jacinto Water System, W&T equipment — some of which is shown above — "has stood the test of time and has been used under many adverse conditions and always with satisfactory performance," according to Mr. Clyde R. Harvill, Superintendent. This dependability and long life result not only from proper design, but from the selection of the right parts and materials for every specific purpose.

Since 1913, W&T research has consistently sought out new designs, principles and materials. Every new development is placed under rigid field tests to prove it can meet the exacting standards that dependable and economical chlorination demands.

When you depend on W&T equipment, you have the assurance that 40 years of experience in the chlorination field is being used to bring you the best in design, parts and materials — selected to stand the test of time.

"Make Your First Choice Equipment That Lasts."

WALLACE & TIERNAN INCORPORATED

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